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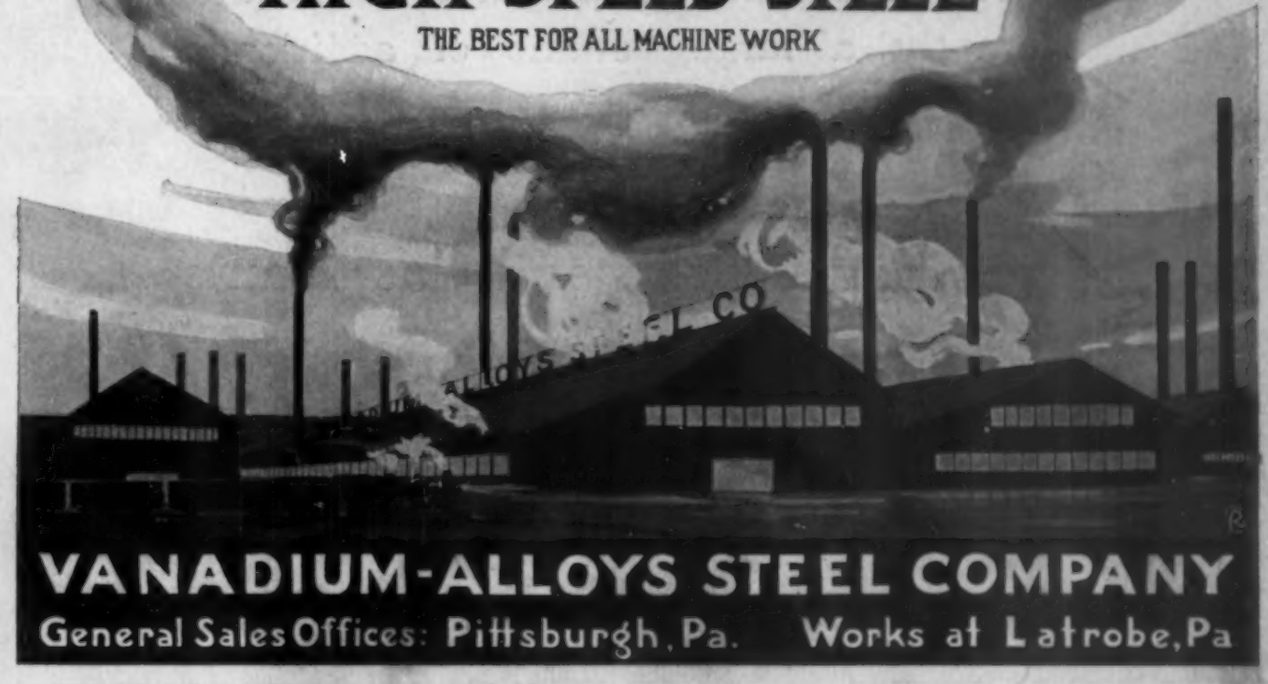

VANADIUM-ALLOYS STEEL COMPANY

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THE IRON TRADE REVIEW

Vol. LIX Cleveland, December 7, 1916 No. 23

Serious Shortage of Sheet Bars

Causes Sheet Mills to Curtail Operations and Embarrasses Users of Sheets—Pig Iron Market Not So Feverish—High Plate Prices

THE scarcity of semi-finished materials, particularly sheet bars, is becoming very serious. Many sheet mills are compelled to shut down for a day or two every week on account of inability to obtain bars and buyers of sheets are also embarrassed. Prices are advancing and 5c per pound seems to be the minimum for No. 28 black, while galvanized is selling freely at from 6.50c to 7c. Buyers of sheet bars in the valley charge that the shortage of that material is due largely to the use of very large tonnages to steel in manufacturing shells.

Plates

At least one eastern Pennsylvania plate manufacturer is now quoting 5c, mill, for sheared plates for delivery in one year. Numerous plate mills have sold so heavily that they cannot take orders for anything except universal plates for any but far distant delivery. The Carnegie Steel Co. will furnish the steel for the two battleships to be built at Newport News and will divide with the Cambria Steel Co. the tonnage required for the two ships to be built at Camden by the New York Ship Building Co. Each of these vessels will require about 17,000 tons of hull material. From 75,000 to 80,000 tons will be required for the four battle cruisers.

Four giant passenger vessels, of 35,000 gross tonnage each, are to be built in American yards by the Internation Mercantile Marine Co., and will fly the American flag.

Pig Iron

Although on the whole the pig iron market is not so feverish, very high prices are being made, notably $30, eastern Pennsylvania, on at least two sales of basic, which is probably the highest quotation ever made on this grade of pig iron. At Buffalo, a sale of 27,000 tons of basic for delivery throughout next year was made to a Canadian foundry interest at $30, furnace. In the Pittsburgh district, several sales of bessemer have been made at $35, an advance of $2 during the week, and at Chicago foundry irons have been marked up $1.50. In the south, prices are high, but some sellers are making a strong effort to keep down quotations. Virginia iron is being shipped into the Cleveland district to an unusual extent and prices are advancing steadily as sales continue.

Pig iron production for November, 3,319,805 tons, shows a slight decrease as compared with October. The outlook is that the production of coke and anthracite pig iron for the year, estimating December, will be about 39,200,000 tons.

Iron Ore

Lake Superior iron ore sellers expressed themselves as satisfied with the sales made in eastern territory, where the furnaces seldom, if ever, buy for more than six months' requirements. Lake Superior iron ore shipments to Dec. 1 made the wonderful total of 63,648,298 tons, which is 14,577,820 tons more than the total tonnage shipped in the entire year 1913, which has held the record up to the present time. Adding December and all-rail shipments, it will not be surprising if the entire movement for this year amounts to 66,000,000 tons. Prices of Port Henry, New York, ores, have been advanced about $1.50 per ton for next year's delivery and sales are being made rapidly at the new schedule.

Pipe

Steel and wrought iron pipe have been advanced $4 per ton. Prices of these products have been marked up from $22 to $24 since Jan. 1. The Philadelphia Co. has placed an order for 20,000 tons of iron and steel pipe to cover its requirements for the last half of next year.

Shapes

New railroad offerings of from 7,000 to 8,000 tons of structural material make a total of about 20,000 tons now pending. Although the prices of both the plain and fabricated materials are much higher than they were a year ago, there is very active competition among fabricating and erecting concerns and in some cases bids on steel erected vary as much as $20 per ton.

THE OPEN HEARTH

Domestic and Foreign Demand

REPORTS which have appeared of late in the daily newspapers, to the effect that purchases of war materials, including machinery, by England and her allies are of diminishing proportions, and can be expected still further to diminish in the near future, if not inspired by the desire to depress prices or exert some other ulterior effect, at least are not founded on truth. The fact that contracts here and there have been canceled, due to the inability of the concerns involved to make deliveries or to meet the requirements of inspection; and that contracts in some cases have not been renewed, because the use of the materials involved had been discarded in favor of more effective munitions, does not prove that there is a decreasing demand. At all times since the war started, responsible manufacturers have had no difficulty in getting contracts for furnishing war munitions, and it is safe to say there now is no concern in this country, desirous of engaging in the manufacture of munitions, and capable of satisfying the purchasers as to its ability to make the munitions that are wanted, and its capacity to make deliveries, which has been unable to get a contract.

Indication are that the present situation with regard to war requirements will show no change for a long time to come. With at least 75 per cent of the iron and steelmaking capacity of Europe, the machine shops of Belgium and a large proportion of the machining capacity of France and Russia in German hands; with the already enormous tonnage requirements of the battlefronts still increasing; and with the fact well known that both England and France some time ago achieved the maximum organization in the manufacture of munitions, the opinion of *The Iron Trade Review* is that the resources of the United States, in every way in which they are available, will continue to be drawn upon by the allies.

It is true, however, that recently there has been a marked increase in the domestic demand for machine tools and a striking feature of this development is the fact that those concerns which recently have placed million-dollar tool contracts are not engaged to any great degree in the manufacture of munitions. The ship-building companies alone have placed orders for heavy equipment that reaches far into the millions, and they are building many boats for our coastwise trade; the automobile manufacturers who have not and do not expect to enter the war order game, are daily issuing lists that involve stupendous totals; builders of farming machinery have scoured the country for equipment; concerns making metal products, furniture, doors and window sash have bought extensively. War orders still exist, to be sure; millions are being spent and will continue to be spent for equipment to make war possible, but aside from Europe's disaster, American enterprise engaged in entirely peaceful lines, is firing broadside salvos into tool builders demanding deliveries. The buyers are bombarding the markets for equipment at any price.

Another important feature of the machinery market of the present time is the increasing tendency of manufacturers in the United States to give preference to domestic orders. Many concerns which at first branched out into munitions manufacture have given up this line of activity because they have found it more profitable to devote their efforts to their regular products. In some respects, the foreign business has proved a source of much annoyance and manufacturers of this country are thinking more and more of the time after the war and are endeavoring to so conduct their business now that relations with domestic buyers in post bellum years will be entirely cordial. The home market will be the main reliance in the years to come.

It is somewhat reassuring to learn that the opening of congress was attended by nothing more threatening than the ill mannered flaunting of a yellow suffraget banner.

Cooperation in Foreign Trade

A FINE example of how legitimate business can be promoted by the government is furnished by the elaborate report which has just been published by the federal trade commission on co-operation in American export trade. As the result of an extensive investigation, the committee finds, first, that other nations have marked advantages in foreign trade from superior facilities and more effective organizations; and, second, that doubt and fear as to legal restrictions prevent Americans from developing equally effective organizations for overseas business and that the foreign trade of American manufacturers and producers, particularly the smaller concerns, suffers in consequence. Hence the commission recommends remedial legislation to permit co-operation among Americans for export trade.

The report consists of two volumes, one of 387 pages and the other of 597 pages, describing at length the character and importance of American foreign trade, general competitive conditions in international trade, and various kinds of combinations which prevail in foreign countries. The books give a large amount of information in regard to business conditions in this and foreign countries. It is clearly shown that while the United States has been absorbed in domestic

THE OPEN HEARTH

development, other nations have followed definite policies of expansion of their foreign trade and have perfected efficient means for the purpose in view. The report shows how, recognizing the vital influence of transportation facilities, foreign nations have built up their ocean shipping, have granted low export railway rates and have combined their land and ocean transportation facilities to give their shippers ready entrance into overseas markets, while the United States has neglected its merchant marine until it is dependent upon commercial rivals to deliver its goods.

Considerable space is devoted to Germany where, prior to the war, there were 600 important cartels or combinations to control the market, including virtually every industry in the market.

In the face of the array of facts presented by the commission and of its positive recommendations, it does not seem possible that congress can long delay in giving American manufacturers a chance to act in harmony in engaging in foreign trade.

Back in the fourteenth century, pots and pans were listed among the crown jewels of Edward III. If the sheet market continues to soar, housewives will be renting safety deposit vaults for their kitchen utensils.

Market Importance of Iron Exports

IN THE various analyses of the fundamental causes underlying the recent upward spurt in pig iron which are being made today by both buyers and sellers, there has been a disposition to place cost factors above all other considerations. It is patent, of course, that costs of production have been undergoing an almost revolutionary change recently and to this fact may be ascribed in a large part the sharply-advanced prices which the furnaces have been demanding for their metal, as a matter of necessity.

In these studies of the causes and effects of the present market conditions, however, the position of supply and demand and some of the unusual factors that bear upon this relationship, must be given full weight. The remarkable export absorption of iron stands out prominently in such a survey. There is a disposition on some sides to minimize the importance and scope of the foreign demand, perhaps for the reason that this has come along in rather a subtle way since the volume of current sales at no time could be accurately gaged. It is pointed out that at the latest reports, we are exporting about 60,000 to 65,000 tons of iron monthly or at an approximate rate of about 750,000 tons annually, and when this amount is considered alongside the 40,000,000-ton rate of total production, it appears to be a minor, and not a major incident.

This is not the essential point, however. Under the present conditions of tremendous demand, the line of demarcation between merchant and non-merchant production of iron or that which is made for sale and that which is for the consumption of the producer, himself, is sharply drawn. In fact, the steel works producers, as they do usually in times of broad markets in steel products, are buying considerable tonnages in the open market over and above their own output. This means that practically all the iron now going abroad is being drawn from merchant furnaces. If the strictly merchant iron production of the country today may be estimated at from 7,000,000 to 8,000,000 tons, as some authorities state, it can be seen that the foreign shipments are eating a big hole into the saleable offerings and that they, in reality, are of the utmost market importance. This is especially true when it is taken into account that they are running at a rate perhaps 500,000 tons, annually, over any other year and at a time when supplies are undergoing an extraordinary pressure.

Will Grow in Popularity

THERE is a strong and well-founded feeling among business men of the country that the federal reserve banking act is a wise measure and that it is likely to help greatly in getting over rough places in financial matters of the future, but it is clear that one of the very best provisions of the new law, that relating to trade acceptances, is not being taken advantage of except in a very limited way. There are, however, a few clear-thinking and far-seeing business men who recognize the possibilities of the use of the trade acceptance. The volume of documents of various kinds relating to this subject is increasing rapidly and some manufacturers are making a determined effort to extend the use of acceptances. An admirable pamphlet entitled "Why Accept?" has been issued by the Federal Reserve Bank of Cleveland.

Ernest F. DuBrul, who, a number of years ago, was commissioner of the National Metal Trades Association and is now engaged in manufacturing in Cincinnati, is doing some excellent work in advocating the use of trade acceptances and an address which he delivered before the Cleveland chamber of commerce Tuesday of this week has received high commendation. In times of great prosperity when men are extremely busy, it is difficult to get them to give time and thought to problems apparently not of immediate importance, but the trade acceptance is bound to receive greater attention as its importance is more fully realized.

Nearly Forty Million Tons of Iron

Will be Made by Blast Furnaces of the United States This Year—November With 30 Days Shows Slight Decrease in Production

PIG iron production still continues at the same lively rate and it is now certain that the production figures for 1916 will be close to 40,000,000 tons. The production of coke and anthracite pig iron in the United States, estimating December production, will reach about 39,200,000 tons, and this with charcoal pig iron production, which will amount to at least 284,000 tons, will give the immense total of 39,484,000. In 1913, which was the record year, the tonnage of coke and anthracite pig iron amounted to 30,652,767, while in 1915, the total tonnage was 29,572,194.

MONTHLY PRODUCTION.

	1916.	1915.	1914.
January	3,171,878	1,591,024	1,879,336
February	3,078,548	1,666,592	1,888,607
March	3,327,630	2,046,280	2,341,551
April	3,225,496	2,114,518	2,261,501
May	3,364,584	2,255,157	2,097,019
June	3,213,818	2,369,933	1,904,566
Total 1st half.	19,381,954	12,043,503	12,372,580
July	3,221,127	2,563,311	1,955,324
August	3,197,838	2,774,825	1,996,483
September	3,208,041	2,834,342	1,882,718
October	3,508,180	3,120,340	1,767,227
November	.....	3,035,235	1,501,269
Total mos.	35,836,945	26,371,556	21,475,601
December	.....	3,201,605	1,495,325
Total 2d half.	.....	17,529,658	10,598,346
Grand total.	35,836,945	29,573,161	22,970,926

The total production of coke and anthracite pig iron in November was slightly below that for October, but as there is one less day in November, the decrease in production is not very large, November figures being 3,319,805 tons, compared with 3,508,180 tons in October, a loss of 188,375 tons. The daily average production last month amounted to 110,660 tons, a loss of 2,507 tons, compared with the daily average for October, which was 113,167 tons.

Steel works, or non-merchant furnaces, produced 2,397,635 tons in November, a loss of 163,562 tons, compared with October, while the merchant furnaces produced 872,757 tons last month, compared with 904,769 tons in October, a loss of 32,012 tons. The loss in the daily average production of steel works furnaces amounted to 2,698 tons, the figures for November being 79,921 tons, and for October, 82,619 tons. The merchant furnaces lost only 94 tons daily last month, November showing a daily average of 29,092 tons, and October, 29,186 tons.

The 30-day month of November also shows a loss in ferro production. There were 22,653 tons of ferro produced in November, compared with 29,604 tons in October.

The following merchant furnaces were blown in in November: Furnace F, Colorado Fuel & Iron Co., Nov. 22; one Iroquois, Miami Products Co., Nov. 16; Lawrence, Marting Iron & Steel Co., Nov. 3; one United, United Alloys Production Co.; North Cornwall No. 5, Lackawanna Iron & Steel Co., Nov. 9; No. 4, Shenango Furnace Co., Nov. 13; Bay View No. 2, Illinois Steel Co., Nov. 6. The following merchant furnaces were blown out: Furnace B, Nov. 28, and Furnace C, Nov. 23, M. A. Hanna & Co.; Nov. 4, Rogers, Brown & Co., Nov. 27; Blanche, Marting Iron & Steel Co., Nov. 24; one Warwick, Eastern Steel Co., Nov. 26; Rockdale, J. J. Gray, Nov. 1.

The steel works furnaces blown out were as follows: Furnaces D and F, Colorado Fuel & Iron Co., Nov. 22; one Edgar Thomson, Nov. 1, and two Lucy and one Clairton, Nov. 25, Carnegie Steel Co.; No. 1, Worth Bros., Nov. 26.

AVERAGE DAILY PRODUCTION.

	1916.	1915.	1914.	1913.	1912.
Jan.	102.319	51,323	60,624	89,929	66,220
Feb.	106,157	59,521	67,450	92,095	72,372
Mar.	107,343	66,009	75,534	89,123	77,791
Apr.	107,517	70,484	75,383	91,812	79,254
May	108,535	72,747	67,646	90,865	80,753
June	107,127	78,998	63,486	87,229	81,125
July	103,907	82,687	63,075	82,525	77,502
Aug.	103,156	89,510	64,403	81,839	80,650
Sept.	106,935	94,478	62,757	83,137	81,482
Oct.	113,167	100,656	57,007	81,933	86,569
Nov.	110,660	101,174	59,042	74,322	87,985
Dec.	.....	103,278	48,236	63,746	89,590
Av'r'ge	106,976	81,022	62,934	83,980	80,124

NOVEMBER PIG IRON

States.	No. of stacks.	No. in blast last day of month. Nov.	Oct.	Total tonnage made. Merchant.	Non-Merchant.	Totals.— Nov.	Oct.
Pennsylvania	154	129	133	255,196	1,093,337	1,348,533	1,460,071
Ohio	76	67	66	194,241	539,290	733,531	764,759
Alabama	45	29	29	139,180	94,699	233,879	246,827
Virginia	22	8	8	29,102	.....	29,102	31,762
New York	26	17	20	73,662	110,463	184,125	195,397
New Jersey	6	1	1	6,384	.....	6,384	7,431
Illinois	24	24	23	53,593	279,738	333,331	342,188
Colorado	6	3	4				
Indiana	10	10	10	32,148	221,521	253,669	270,066
Maryland	4	4	4				
Wisconsin	6	5	4				
Kentucky	7	4	4				
West Virginia	4	4	4	54,165	31,367	85,532	81,525
Tennessee	17	10	11				
Washington	1	0	0				
Georgia	2	0	0				
Texas	3	0	0				
Minnesota	3	3	3	35,086	27,220	62,306	65,940
Michigan	3	3	3				
Missouri	1	1	1				
Spiegel—All states						22,653	12,610
Ferro—All states						26,760	29,604
Totals	420	322	328	872,757	2,397,635	3,319,805	3,508,180

Port Henry Ore

Prices Are Advanced About $1.50 Over This Year's Prices

New York, Dec. 6. (By wire.)—Port Henry iron ore prices for the 1917 season have been fixed on a basis of $1.50, an advance in some grades and slightly more in others over last year. The relative advance, however, is less than for the lake ores, because of the greater richness of the Port Henry mineral. The new prices are equivalent to 10½ to 11 cents per unit delivered to eastern furnaces on old bed 58 per cent crude, depending on destination, 11 to 11½ cents per unit, delivered, on old bed 65 per cent concentrates, 11½ to 11¾ cents per unit, delivered, on Harmony 63 per cent concentrates, and $5.75 per ton at Port Henry on lump. All these ores are non-bessemer. Practically a similar advance is made on Barton Hill bessemer ores.

Sales and reservations of Port Henry ores at the new prices have been very heavy, totaling well over 1,000,000 tons and taking up virtually the capacity of production for the season. Local eastern ores are being settled on the new price basis of 11 to 12 cents per unit, delivered.

Tool Market Again Hits High Spots

Business Placed During November May Break Record—Ship Builders Weary Dealers With Their Insistent Cries for Tools—Railroads Buy Cautiously—Price Advances Made

NOVEMBER, although not abounding in sales of sensational magnitude, was an exceedingly satisfactory month from the standpoint of machine tool manufacturers, and a number of leading concerns doing a country-wide business report that it was the best month in their history. Most of this volume of business was contributed by domestic concerns in practically all lines of industry; the most active buying, it appears, was done by concerns in the ship building and steel industries. Among the interesting developments of the month were reports, more or less widely distributed, to the effect that the allied governments would place no more orders for finished shells or rifles in this country and that they were endeavoring to cancel contracts previously placed, and other reports that the machine tool market shortly would be flooded by offerings from leading munition makers. Whether or not these reports were designed to depress the market, they were not received with great seriousness.

Machine Tools Again Advanced

The market now is as strong from the standpoint of the volume of business on books as at any previous time, and prices during the month showed a further tendency to advance. For instance, high-speed drill presses were advanced 12½ per cent on Nov. 10, making the quotations on these tools about 25 per cent higher than they were two years ago. At about the same time, upright drill presses were advanced about 10 per cent also, making prices about 25 per cent higher than they were two years ago. Later in the month, one of the prominent lathe builders advanced its quotations on all sizes of lathes from 12 to 42 inches by approximately 12½ per cent and the new quotations are higher by that amount than the general level now prevailing. It was considered sometime back that lathes had about reached the maximum price level, but in view of this advance, it is considered not unlikely that other makers will follow suit.

Ship Yards Inquire and Buy Heavily

One of the largest buyers during the month was the Ames Ship Building & Dry Dock Co., of which Edgar Ames, vice president of the State Bank of Seattle, is president; this concern is to build a 6-berth ship yard at Seattle, Wash. Another large purchaser was the Standard Ship Building Corporation, 44 Whitehall street, New York, which bought between $200,000 and $300,000 worth of equipment for its plant at Shooters Island, New York. Other ship builders who bought good-sized requirements are the Texas Steamship Co., Bath, Me.; the Sun Ship Building Co., Chester, Pa.; the American Ship Building Co., Cleveland and the Lorain, O.; the Toledo Ship Building Co., Toledo, O., and others. Considerable interest to machine tool builders attached to the announcement that Chas. W. Morse, president of the United States Steamship Co., 50 Broad street, New York, had bought a site near New London, Conn., on which he proposes to establish a large ship yard. The Lake Torpedo Boat Co., Bridgeport, Conn., put out inquiries during the month for a large list of tools.

The railroads did not buy on a large scale during the month. The most important buying by these interests came from the Missouri, Kansas & Texas railroad, the Pittsburgh & Lake Erie and the Pennsylvania lines west. Other roads which purchased are the Lehigh Valley and the Baltimore & Ohio. Among the roads which issued new inquiries are the Southern, the Pennsylvania lines west, the New York, New Haven & Hartford, the Chicago, Milwaukee & St. Paul, the Fort Smith Western and the Santa Fe.

Munition Makers and Heavy Equipment Builders Buy Freely

Considerable business during the month came from the concerns engaged in the manufacture of war munitions. The Westinghouse Machine Co. ordered about 50 tools; the Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., and the Marlin Arms Corporation, Hartford, each bought a large amount of equipment. Both concerns still have large requirements yet to be placed. Among the steady buyers of the month were the Bethlehem Steel Co. and the General Electric Co. These concerns placed orders almost every day for considerable equipment so that the total business contributed by each during the month was of large proportions. A large buyer was the Morgan Engineering Co., Alliance, O., which placed orders for a complete machine tool equipment, including heavy units principally, for installation in a new erecting shop. The Pittsburgh-Des Moines Steel Co. closed for a large amount of equipment. The Pusey & Jones Co., Wilmington, Del., bought approximately $100,000 worth of tools. Another large buyer was the Beach Mfg. Co., Montrose, Pa., manufacturer of woodworking machinery, which bought a complete equipment to replace that lost in the burning of its plant Nov. 24. The Carnegie Steel Co. bought a large amount of equipment for various plants and continues in the market. The United States government purchased a large amount of equipment for installation in navy yards and it is expected that considerable additional buying either by the government or by concerns which will do government work, will result in the near future.

Foreign Buying Revives After Short Depression

Demand for machine tools for export showed an increase during November. J. P. Morgan & Co. put out several large lists including lathes, milling machines and other tools and encountered much difficulty in making the purchases due to the poor deliveries available. Theo Heide, managing director of the Rosenberg Mek. Verksted, Stavanger, Norway, bought a large quantity of ship yard and machine shop tools. W. F. Davis, 149 Broadway, New York, put out an inquiry for a large number of tools for shipment to Italy. H. Arentz, director of the Copenhagen Floating Dock Co., and B. I. Avilov, director of the Aksai Mfg. Co., Nachitchevan, Russia, arrived in New York with large lists of tools to be purchased immediately.

Prices Present and Past

(Yesterday, a month ago, three months ago and a year ago.)

Quotations on leading products December 6, average for November, 1916, average for September, 1916, and average for December, 1915. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Dec. 6, 1916.	Aver. for Nov., 1916.	Average for Sept., 1916.	Aver. for Dec., 1915.
Bessemer pig iron, Pittsburgh	$35.95	$30.35	$22.20	$19.85
Basic pig iron, Pittsburgh	30.95	25.95	19.075	18.55
No. 2 Fdy. pig iron, Pittsburgh	30.95	26.76	19.50	18.85
Northern No. 2, Fdy., Chgo.	29.00	25.00	18.65	18.00
Lake Superior Charcoal, Chgo.	31.75	23.00	19.75	19.15
Malleable, Chgo.	29.00	25.00	19.15	18.10
Southern No. 2, Birmingham	22.00	15.13	13.75	13.13
Southern Ohio No. 2, Ironton	30.00	19.60	14.38	14.13
Basic, eastern Pa.	30.00	25.00	20.00	18.00
No. 2X Virginia furnace	26.50	23.00	17.50	17.00
No. 2X foundry, Philadelphia	28.50	25.00	19.75	19.25
Ferro mang., Balti.	160.00	160.00	164.00	100.00
Bessemer billets, Pbgh.	60.00	52.00	45.00	29.60
Bess. sheet bars, Pbgh.	60.00	52.00	45.00	30.80
Op.-h'th sh. bars, Pbgh.	60.00	52.00	45.00	30.80
Open-hearth billets, Pbgh.	60.00	52.00	45.00	30.20
Steel bars, Pittsburgh contract.	.....	2.78	2.60	1.74
Steel bars, Chgo.	3.09	2.89	2.79	1.97
Steel bars, Chgo., contr.	3.09	2.60	2.50	1.625
Iron bars, Philadelphia	2.909	2.659	2.659	1.959
Iron bars, Cleveland, local del'y	3.00	2.70	2.40	1.75

	Prices Dec. 6, 1916.	Aver. for Nov., 1916.	Average for Sept., 1916.	Aver. for Dec., 1915.
Iron bars, Chgo. mill	$2.70	$2.52	$2.35	$1.70
Beams, Chgo. contr.	3.19	3.03	2.79	1.97
Beams, Pittsburgh, contr.	3.00	2.88	2.60	1.74
Beams, Philadelphia	3.159	3.059	2.759	1.959
Tank plates, Pbgh., contract	3.50	3.35	2.95	1.74
Tank plates, Chicago contr.	3.69	3.46	3.19	1.97
Tank plates, Philadelphia	4.159	3.909	3.909	1.959
Sheets, blk., No. 28, Pbgh.	5.00	3.67	2.887	2.54
Sheets, blue an., No. 10, Pbgh.	4.00	3.30	2.925	2.23
Sheets, galv., No. 28, Pbgh.	6.75	5.07	4.22	4.75
Wire nails, Pittsburgh	3.00	2.85	2.60	2.02
Connellsville fur. coke, contr.	3.75	3.75	2.48	2.35
Connellsville fdy. coke, contr.	6.00	5.50	3.17	3.00
Heavy melting steel, Pbgh.	24.00	20.55	16.125	17.40
Heavy melting steel, eastern Pa.	24.00	20.00	15.00	16.00
Heavy melting steel, Chgo.	23.50	19.35	15.50	18.40
No. 1 wrought eastern Pa.	26.00	23.50	21.00	20.00
No. 1 wrought, Chgo.	25.00	21.25	16.62	15.15
Rerolling rails, Chgo.	29.50	24.90	16.90	16.70
Car wheels, Chgo.	21.50	15.95	12.00	14.75

(For Additional Prices See Page 1178.)

Very High Prices for Basic Pig Iron

Sales by an Eastern Pennsylvania Maker at $30, Furnace—November a Record Breaking Month in the East—Buffalo Sellers of Malleable Out of the Market

New York, Dec. 5.—Following a tremendous turnover in November, which was a record-breaker in the volume of sales in this territory, the iron market quieted down, though negotiations still are numerous. Some leading houses disposed of more iron in November than during all the six months preceding. The advance in prices has not been halted, but it is more orderly. A $30 price has been established in the east, especially on basic. At Buffalo, a 27,000 tons basic sale for all 1917 delivery to a Canadian foundry interest, was made at $30, furnace, and makers there now quote $30, minimum, and have asked $31 on all grades. At least two sales of eastern Pennsylvania basic were closed at $30, furnace, for last half. One foundry producer is talking $30, furnace, for No. 2X, but other makers still are below that figure by varying degrees. A 2,000-ton sale to a New Jersey machinery builder at $28, furnace, is noted. A large local buyer is quietly figuring on 5,000 to 10,000 tons. A 5,000 tidewater basic negotiation still is open. Lake Superior charcoal has been advanced to a minimum of $31.84, Buffalo.

The south seems to have been cleaned up pretty much on early iron and this fact has reduced the selling for export, though the inquiry from that direction is as heavy as ever. The opinion is voiced in the trade that foreign buyers now will begin to draw more heavily upon Virginia and northern districts where more metal for nearby shipment is available. A 1,500-ton sale of foundry iron to Denmark was made at $24, Birmingham. Purchasing representatives of belligerent European governments remain in the market for round lots of bessemer and are being quoted $35, furnace. Scandinavian countries are heavy inquirers, with probably 15,000 tons for them now current. Italy has about 30,000 tons, mostly bessemer, in the market.

Prices Still Climbing

Pittsburgh, Dec. 5.—W. P. Snyder & Co., on Dec. 1, announced the November price averages of steelmaking grades, based upon actual sales of 1,000 tons or more by valley furnaces. The average price of bessemer iron last month was $29.122, compared with $23.6576 in October, representing an advance of $5.4644. Compared with the average price registered the corresponding month of 1915, bessemer iron in November advanced $12.507. The average price of basic iron in November was $27.229, or $6.9204 above the average price of October. Compared with the average price for the corresponding period a year ago, basic iron in November advanced $11.711. Advances made by steelmaking grades last month were the sharpest recorded in many years. About 50,000 tons of bessemer iron and 75,000 tons of basic iron figured in the computations.

Demand for pig iron is heavy. The Follansbee Bros. Co., Pittsburgh, are negotiating for 10,000 tons of basic pig iron for shipment the first half of next year to their plant at Follansbee, W. Va. A broker who paid $35, valley, for 500 tons of bessemer iron last Saturday is now negotiating for 1,500 tons. All of this iron is for export. Pending inquiries involve 12,000 tons of basic iron for delivery the first half; 1,500 tons of basic for the first quarter, and 3,000 tons of bessemer iron for the first quarter. Bessemer iron is well pegged at $35, at which figure a valley interest yesterday sold 1,000 tons. Scattering lots of basic iron have been sold at $30 and foundry and malleable are commanding that figure. A local foundry has purchased about 10,000 tons of bessemer iron for 1917 delivery at $32, furnace.

Chicago Rise Continues

Chicago, Dec. 5.—Northern No. 2 foundry and malleable pig iron have

(*For complete prices see page* 1178.)

advanced to $29, furnace, for 1917 delivery. One sale for prompt delivery is noted which brought $30, furnace. Comparatively little iron is available for prompt shipment, although there is some demand for additional supply, and melters are seeking to have some of their shipments anticipated, a task which is difficult to accomplish in the present situation as to railroad cars.

Good inquiry is being entertained, mostly for last half of 1917. This is not coming with a rush, as consumers apparently have not yet made up their minds as to the probable movement of the market during the next six months. Comparatively little inquiry is being received for first half delivery, as most melters seem well covered for that period. Furnaces have little iron unsold for that delivery, and if a demand develops later, it is difficult to see how it will be met.

Considerable demand is being entertained for bessemer and basic iron for export, but this is not being booked by Chicago furnaces at present. A big feature of the market is a strong demand for basic iron from this district for shipment to the valleys. This iron is wanted for any delivery and is coming for fairly large tonnages. So far, none of this business has been placed here.

Lake Superior charcoal iron is being quoted at $31.75, delivered, Chicago, for the cheaper grades, but this figure is not guaranteed to last, and some makers are asking considerably higher for the better grades. A recent sale of a fair tonnage of low phosphorus iron is said to have been made on a basis of about $53, delivered, Chicago.

Southern iron is being sold at $23, Birmingham, for prompt delivery, and is exceedingly scarce. Buyers find it difficult to get the small tonnages they need for the remainder of this year, and almost equally hard to place further business for first half delivery. Most southern stacks are sold tightly for the entire first half, and one large producer is said to be entirely sold out on basic for the entire year. For last half delivery prices range from $22 to $24, Birmingham.

Jackson County silveries are strong, and a recent quotation on 8 per cent was $36 at the furnace. This was for last half delivery. Little tonnage remains available for first half delivery, and one producer is asking $38 at the furnace for 8 per cent for delivery during the first half of 1917.

The entire situation here, both as to local irons and those brought here from a distance, seems exceedingly strong, and advances are of almost daily occurrence. Some melters are inclined to believe that last half iron may be cheaper than it is quoted at present, while others are of the opinion that the present prices will carry over and even higher figures will be paid for that delivery. It is interesting to observers to note the working out of this divergence of opinion.

Prices are Steadier

Philadelphia, Dec. 4.—Liberal buying of pig iron goes on steadily and while a rising market is being maintained, prices have been steadier the past week and conditions appear less feverish. First half metal has become scarcer, as many producers are well sold up, but the heaviest demand, as it has been, is for the last half.

One transaction which stands out in the week's business is the sale of 15,000 tons of standard eastern Pennsylvania basic for last half shipment at $30, furnace. It is believed this is the highest price ever paid for eastern Pennsylvania basic. Some of the details of the sale, including the identity of the buyer, have not been disclosed, but the latter is said to be an eastern steelmaker, who has not been in the market recently.

A report that the Midvale Steel & Ordnance Co. bought a tonnage of basic is officially denied. Another buyer is offering $30, furnace, for 0.60 phosphorus basic for last half. There has been some buying of standard bessemer by eastern Pennsylvania consumers, on which $36.78, delivered, or $34, valley, for first half was paid. An Easton, Pa., plant, after recent purchases, is in the market for 1,000 tons additional of early bessemer. A Chester foundry closed for 1,000 tons.

Malleable is scarce and a western Pennsylvania maker, who is reported recently to have sold 5,000 tons at over $33.50, furnace, is quoting $35, furnace. A Philadelphia consumer wants 1,000 tons of early iron, but a last half inquiry for 2,500 tons has been withdrawn. The supply of low phosphorus also is scant and considerably below the demand. Prices on standard iron now are at $50 to $51, Philadelphia, with higher promised. One maker sold 2,000 to 3,000 tons in the week. Lebanon low phosphorus in instances has been quoted over $50, furnace, but the market probably is $48 to $50, furnace.

Foundry iron buying has continued active and well scattered. There is a considerable spread in prices. Some eastern Pennsylvania makers ask $29, furnace, for No. 2X, but central Pennsylvania No. 2X is obtainable at $27, furnace, or $28.65, Philadelphia. Virginia No. 2X still rules from $26 to $28, furnace. A sale of about 500 tons of Alabama No. 2 for last half was made here at $24, Birmingham. A lot of 300 tons of spot Buffalo No. 2X brought $32.58, delivered here, or $30, furnace. A Philadelphia machinery builder closed for 2,000 tons and a Delaware ship builder for a good-sized amount. A spot sale of 1,000 tons of standard forge was made at $26, eastern Pennsylvania furnace.

(*For complete prices see page* 1178.)

Sales of Virginia Iron

Cleveland, Dec. 5.—The selling of Virginia iron in the Cleveland district has been a feature of the past week. One sale of No. 2X was made at $26, Virginia furnace, or $29.20, delivered Cleveland, and the price then was advanced $1 a ton. Some Alabama iron was sold at $24.70, delivered Cleveland, for the last half of the year. Cleveland furnaces are quoting at $30 to $31, furnace, for No. 2 foundry. Many Cleveland foundries have not purchased for the last half of next year and are not inclined to do so at present prices, as they doubt whether the high schedule will be maintained.

Small Sales

St. Louis, Dec. 5.—Inquiries for pig iron in this market are so few as scarcely to deserve mention, and sales last week did not exceed 3,000 tons, made up of northern and southern grades. Prices are stiff, however, and local dealers are confident that some good inquiries will appear soon. Southern iron is strong at $25 a ton, Birmingham, for delivery over the remainder of the year. Northern iron is held at $30, Chicago, and $29 to $30, Ironton.

Continues to Advance

Cincinnati, Dec. 5.—Advances continue on both southern and southern Ohio pig iron. Southern No. 2 foundry has advanced $1 a ton since last week, and is quoted from $22 to $23, Birmingham basis, for the last half of next year. The price for the first half varies all the way from $23 to $25, Birmingham basis, with very little to be had for that delivery. The majority of furnaces in both Alabama and Tennessee have withdrawn from the market. Southern Ohio No. 2 foundry iron has jumped to $28 to $30, Ironton basis, for the last half of 1917, with none available for the first half. Silvery iron is obtainable only for the last half of next year from $36 to $37, furnace, for 8 per cent silicon. The market is quiet, as the majority of melters have covered for the first half of next year and also dealers have very little iron that they can sell. The only inquiry pending before the market is for 5,000 tons of analysis iron, either northern or south-

ern, for shipment over the last half of next year, from an Indiana melter.

Pig Iron Reaches $35

Buffalo, Dec. 5.—One of the leading interests of Buffalo district is quoting an absolute minimum of $35 per ton on any grade of pig iron, and iron sold at this figure is being booked only where the deliveries required fit in with tonnages of the various kinds scheduled for production by this furnace. Another large producer is holding to a minimum of $30 for any grade and the third furnace interest of the district reports that it is absolutely out of the market and is making no quotations on any amounts or any deliveries at the present time.

While fully 10,000 tons of basic were booked here in the past two weeks at $30, the absolute minimum is now quoted at $35. The demands of melters keep up, but little or nothing seems available to meet their needs. Selling interests that have sought to secure iron from other and even remote producing centers for consumers in the Buffalo territory, report that the iron from such sources has become scarce to the degree of being almost unobtainable. There is no longer the factor of yard stocks and available tonnages of re-sale iron to aid furnaces in meeting the demands of the consumers. These sources have been reduced to the vanishing point. Melters are compelled now to depend on furnace production alone, wherever and whenever such is obtainable.

All of the producing interests of the Buffalo district announce that they are absolutely out of the market as far as malleable is concerned. The market on other grades is represented by a range of $30 to $35, not on grade differences, but on the variance in the quotations being made by the different furnaces.

Trend is Upward

Birmingham, Ala., Dec. 4.—The general trend of the southern, or Birmingham pig iron market the past week has been upward, but stability was lacking. For prompt delivery iron the price was between $20 and $23 per ton at the furnace, and for second half delivery the price was between $21 and $22 per ton at the furnace. However, the close of the week has shown a more stable condition, as to both spot iron and iron for 1917 delivery. Now $21 per ton at the furnace is considered the minimum figure, and from that price up to as much as $23 per ton, depending on the ability of the manufacturer to take on more business. Some of the interests have withdrawn from the market and others have not as yet opened their books for the last half of 1917. The Republic Iron & Steel Co. reports that it is not making quotations for the last half, and has withdrawn from the market. This company at present has one of its Thomas furnaces out, but in all probability it will be ready for the torch by Dec. 31.

There are some idle stacks in the district which would be put in commission were there sufficient raw materials in sight. In fact, some of the heaviest producers are having lots of trouble for lack of raw materials—and had not some of them put in heavy stocks during the summer months, no doubt a furnace or two would have to be blown out for lack of material. All the coke ovens in the district are running to capacity, and some of the remotely located old beehive ovens are being repaired.

Low Ferro Prices

Are Named on Sales Made in the Central West

New York, Dec. 5.—Intimations have reached this country during the past week that English makers of ferro-manganese are not so well supplied with manganese ore stock as had been assumed and this fact may tend to prevent their making any reductions in their prices to meet the lower quotations of domestic producers. Some of the English makers, as previously noted, have stated recently they will be unable to take any additional orders before the second quarter of next year. Further business put up by the agents to their principals during the past week has resulted in the reiteration by the latter of their unwillingness to make any lower prices than $164, seaboard, at the present time. The uncertain position of the foreign producers on ore supply is making it questionable whether price reductions will be made, although some well-informed persons in the trade still believe that such cuts eventually will be forthcoming. It develops that English makers have on their books a fair amount of first-class business which they took several months ago at $175, seaboard. Furthermore, they will carry over into the new year considerable undelivered tonnage.

Despite the statements of firmer prices on the domestic product which appear to be well-founded, as far as the eastern districts are concerned, the past week has displayed further evidence of considerable irregularity. This has been conspicuously true in the central west, where an Ohio river consumer was able to purchase 2,400 tons for all of 1917 shipment at $155, delivered. It is claimed that this sale exhausts all the metal that is obtainable at this figure. There also were good-sized sales in the week in the middle west and Pittsburgh district at $160, delivered. One buyer in the Chicago district placed 3,000 tons, a Pittsburgh district consumer 500 tons and there was another sale of 1,000 tons. An eastern tidewater consumer was the buyer of 600 to 800 tons at a reported price of $164, delivered, or about 60 cents under the English quotation. Most of the recent inquiry totaling 5,000 to 10,000 tons, has been worked off and practically all of this has been booked by the home makers. The English furnaces have taken only small and unimportant lots. New inquiry now is lighter.

An Ohio steelmaker bought 1,000 tons of early spiegeleisen at a reported price of $50, delivered. Inquiries are considerable, totaling 3,000 to 4,000 tons of domestic for all next year and 1,000 to 2,000 tons for export. The open quotations remain $50 to $55, furnace, for 20 per cent.

Large steelmakers apparently have covered for heavy tonnages of 50 per cent ferro-silicon for next year at prices reported to be around $95, Pittsburgh. It is now difficult to induce makers to take additional orders.

Inquiries for Ore

Philadelphia, Dec. 5.—Three inquiries for single-cargo lots of 5,000 to 6,000 tons each of first-grade foreign manganese ore, are in the market from domestic consumers for first half shipment. Offerings, however, are scarce, due both to restricted supply and to lack of shipping facilities. The present market on 50 per cent or better manganese ore is around 67 cents, per unit, at tidewater. The Carnegie Steel Co. still is offering, for domestic ore, under a recent advanced schedule, from 46 to 55 cents, per unit, delivered, for 40 to 49 per cent content, respectively.

Prices Unchanged

Pittsburgh, Dec. 5.—Prices of ferro-alloys are unchanged in the Pittsburgh district. Dealers are asking $165 a ton for 80 per cent ferro-manganese, although occasional reports of sales at $162 are heard. Spiegeleisen is being held at $55, furnace, by one prominent seller. Prices of lower grades of bessemer ferro-silicon are regarded as nominal; 10 per cent material is being held at as high as $42, furnace, by some sellers.

Z. B. Leonard, metallurgist, has resigned from his position as laboratory head of the Perfection Spring Co., Cleveland.

(*For complete prices see page* 1178.)

Sheet Shortage is Serious

Black Sold at $100 Per Ton—Sheet Metal Workers Embarrassed —Plants Closed on Account of Having No Material

Youngstown, O., Dec. 5.—Black sheets at 5c are now a solid reality in the Mahoning valley; and one leading producer yesterday, after selling 700 tons at that price, tacked up 5.50c. The higher figure was quoted mainly to discourage further inquiry. Undoubtedly, regular and heavy customers of the various mills are getting a slightly lower price, but the figures named represent the general market, such as it is.

Most of the leading producers are out of the market for anything like prompt delivery, and few quotations are being made for 1917 business. With sheet bars climbing, and continuing to climb, and most of the other factors of production uncertain, the sheet manufacturer is taking no chances. Tonnage is in many cases pledged to regular customers, but generally without any definite quotation. Buyers of sheets are glad enough to get the pledges.

Blue annealed sheets are selling at the wide range of 3.75c to 4.75c; galvanized at from 6.50c to 7c.

Delegates from 25 councils of union sheet metal workers throughout Ohio have just closed a session at Youngstown at which it was decided to ask assurance of the manufacturers that work will be more regular. Most of the sheet plants have had shutdowns of from one or two days to a week at a time, because of inability either to buy or procure delivery of sheet bars. The delegates charged that shortage of bars is due mainly to the heavy manufacture of shell steel and consequent neglect of other lines.

The meeting of the delegates is expected to have no serious effect on the labor situation, as the men know that the manufacturers are doing the best they can under difficult circumstances, and that the manufacturers themselves are equally anxious to operate their mills at full time.

The car-shortage situation is little or no better this week. A day or so each week slight relief appears, but there has been nothing like steady improvement. There is some hope in the purchase of more cars by the railroads, but the real trouble is believed in this territory to be lack of operating power—lack of men, principally.

Demand for blue annealed has increased within the last week, which is reflected in the rise of the maximum price. Willingness to pay 4.75c for prompt delivery is not unusual. Galvanized is in such insistent demand that there are plenty of buyers willing to pay 7c for as much as they can get. Except for scattered transactions the black sheet market with its almost prohibitive maximum of 5.50c, is practically a closed book.

Odds and Ends

Cleveland, Dec. 5.—It is still extremely difficult to get quotations on sheets, but one agency will have a considerable tonnage made up of odd lots which will be offered in a few days by a valley concern.

Vigorous Buying

Philadelphia, Dec. 4.—Sheet buying of eastern makers for the first and second quarters is very active and some producers declare it is the most vigorous they ever have seen. Prices still are rising with leading eastern mills, but this is not deterring buyers in the least, as the latter apparently are able to work up their material with good profits and there is little evidence of speculation. A large eastern maker advanced again this week to 4.25c minimum for No. 10 gage blue annealed, while in some cases 4.50c is quoted and has been paid. The Pennsylvania railroad was the buyer of 1,000 tons of sheets from an eastern maker for coach building at Altoona. The foreign demand for sheets is active, but the mills show less interest in it.

Sheet Prices Nominal

Pittsburgh, Dec. 5.—Prices of steel sheet products are nominal. The more important manufacturers have withdrawn from the market entirely and it is not likely that much tonnage will be sold until mills open books for delivery after July 1, next. The American Sheet & Tin Plate Co. is still quoting black sheets at 4c, base, but it is apparent that the average consumer cannot shade 4.25c; some tonnage is commanding 4.50c. Galvanized sheets are selling at 6c and above, although sales do not involve much tonnage. This is not surprising, in view of the fact that not more than 35 per cent of the galvanizing capacity of the entire country is employed. Blue annealed sheets are selling at a wide range, but no tonnage is being offered at less than 3.50c for No. 10 gage.

Heavy demand exists for export, and premium prices are being paid for special sheets for shipment to all parts of the globe. Electrical sheets, in particular, are in demand for shipment abroad.

(*For complete prices see page* 1178.)

Coke Delivery

Is Somewhat Relieved by Improvement in Car Supply

Pittsburgh, Dec. 5.—Shippers of Connellsville coke say the car situation is somewhat more satisfactory this week, but prices of coke show no important change in position. Blast furnace fuel is commanding from $7.50 to $8 a ton for prompt shipment and foundry coke is selling at about $9.25 a ton for spot delivery. The contract market is quiet, although several inquiries are pending for both furnace and cupola fuel for 1917 shipment. *The Connellsville Courier*, for the week ending Nov. 25, says production was 408,169 tons, compared with 398,299 tons the week before.

Scarcity in East

Philadelphia, Dec. 5.—Further small sales of spot Connellsville furnace coke were made to eastern consumers during the week at $7.75, ovens. Latrobe producers in the week refused bids of $7.50, ovens, and now are asking $8, ovens. Some sales of spot Connellsville foundry coke were made at $9.50, ovens. The supply of early fuel still is scant and middlemen have difficulty in finding fuel which they can offer against current inquiries.

Steady at Cincinnati

Cincinnati, Dec. 5.—The coke market has steadied, following a somewhat wild and agitated state that existed last month. No foundry coke is to be had for contract shipment, but furnace coke is available for the first of the year from Wise county and Pocahontas districts at $6 to $8, ovens, for six months' delivery and from $5 to $7 for shipment over the whole of 1917. Spot coke is being sold all the way from $8 to $10, ovens.

Small Tonnages

St. Louis, Dec. 5.—Coke inquiries are confined to prompt shipments of small tonnages. Connellsville 72-hour foundry grades are strong at $10 to $10.50, ovens, and Virginia foundry grades at $9.50 to $10.50, ovens. St. Louis makers of by-product coke are not making any quotations except from day to day. Domestic grades are held at $8.50, ovens. The supply of by-product coke is equal to the demands, but no new business is sought.

Horace N. Trumbull has been appointed advertising manager of the SKF Ball Bearing Co., Hartford, Conn.

Bars for First Quarter

Are Being Sold at 3.25c, But Mills Are Not Anxious to Book Large Tonnages—Pennsylvania Railroad Buys

Philadelphia, Dec. 4.—The Cambria Steel Co. has formally notified its agents that it now will consider first quarter contracts for steel bars from miscellaneous buyers, yet uncovered, at 3.25c, Pittsburgh. This producer formerly was naming 3c, Pittsburgh. The large buyers, such as the implement trade, railroads, etc., placed first half contracts some time back, but there are numerous 500 to 1,000-ton customers still to be taken care of. The mills generally make it clear that they want no more of this business than they are bound morally to assume. The common and minimum price on steel bars is 2.90c, Pittsburgh, but small sales for shipment at mill convenience are being made at 3c, Pittsburgh, and such transactions were done in this district this week. The Pennsylvania railroad has closed with an independent maker for the 2,000 tons of first half bars it inquired for last week.

Bar Iron Advanced

New York, Dec. 5.—Eastern makers of bar iron have announced a new advance of $5 a ton, effective Dec. 1, which brings the new price to 2.75c, base Pittsburgh, or 2.909c, Philadelphia, and 2.919c, New York. The last general advance in eastern bar iron was to 2.50c, Pittsburgh, but this price until recently has been subject to shading of $2 a ton by some producers. Spike prices also have been advanced, bringing the new price to 2.90c, eastern Pennsylvania mill, for standards.

Rebuilding Plant

Cleveland, Dec. 5.—Bids are being received today by the city of Cleveland on 1,000 tons of reinforcing bars for the rebuilding of the filtration plant on the west side. The usual quotation on rerolled bars is 2.90c to 3c, mill, but it is probable that considerably lower will be quoted on the filtration contract.

Withdrawing from Market

Buffalo, Dec. 5.—Extended deliveries and the tendency of prices to advance by leaps and bounds has caused several of the leading producing interests to practically withdraw from the market on bars and other finished lines. These mills have no nearby tonnages available and are not inclined to commit themselves on tonnages for remote deliveries. The principal activity of the mills at this time is to get out tonnages under contract. While prices remain nominally at 2.90c, bars are actually bringing from 3c to 3.25c. It is expected that the nominal asking price will soon be advanced to a point more closely approximating the actual sales prices being made.

Expect Higher Bar Price

Chicago, Dec. 5.—Although the price of soft steel bars has been advanced repeatedly and mills willing to take tonnage have booked practically their entire output for the year 1917, there is an actual increase in inquiry from all sources and contracting is being done at a heavier rate each month. One important interest in the west, which has been selling continually for such delivery as can be made, not sooner than last quarter of 1917, finds November the heaviest month for new business during the present year. It is believed that comparatively little tonnage of bars or other forms of finished steel remains available for delivery during next year.

Although the price is high, it does not seem to deter consumers from seeking further tonnage and it is believed a further advance will be made within a short time, possibly during the present week.

Hard steel bars continue steady at 2.75c, Chicago mill, with good demand, mostly for concrete reinforcing, although some demand is also being received from agricultural implement makers and others who are substituting hard for soft steel bars.

Bar Iron Marked Up

Pittsburgh, Dec. 5.—While no formal change has been made in the price of steel bars since the adoption of the 2.90c figure by the Carnegie Steel Co., yet manufacturers are selling scarcely any tonnage at that quotation. It is not unlikely that steel bars will be advanced $5 a ton before Jan. 1. Domestic demand is described as heavy and inquiries for export involve considerable tonnage. Bar iron manufacturers in this district now are asking 3.25c, or $5 a ton above the previously prevailing price.

Bar Iron Strong

Chicago, Dec. 5.—The bar iron market in Chicago is still represented by a quotation of 2.65c to 2.75c, with most transactions at the higher figure. The minimum quotation still persists in some sales and while it is less a factor than last week, it has not yet entirely disappeared. Inquiry continues excellent, and some mills which are well booked for first half are turning down almost all business offered them. This situation comes about from the fact that almost all regular customers have covered their probable requirements for first half and present demand is from railroads and railroad car builders who have not used this material to any large extent in the past. The fact that an unusual number of wooden freight cars are being built accounts for the larger demand for bar iron in their construction.

Conditions are such that it is believed the price will continue to advance, especially in view of the increased cost of raw material and labor, taken in connection with the continuous demand, especially from sources not usually depended on for an outlet.

(*For complete prices see page* 1178.)

Cold Rolled Steel Shafting

Pittsburgh, Dec. 5.—The 20 per cent off the list price of cold rolled steel shafting gradually is disappearing. Some mills are refusing to shade 15 per cent off the list and that price likely will represent the market at an early date. Deliveries are much more satisfactory than they were a few weeks ago.

Hoops and Bands

Pittsburgh, Dec. 5.—The Carnegie Steel Co. has made no change recently in its price of hoops and bands, quoting the former at 3.25c and the latter at 2.90c for delivery at its convenience. Mills in a position to ship material before April 1 are obtaining 4c and above for hoops and about 3.85c for bands.

Cold Rolled Strip Steel

Pittsburgh, Dec. 5.—Quotations below 7c, base, virtually have disappeared, according to manufacturers of cold rolled strip steel. The bulk of the tonnage for first quarter shipment has been sold, but mills have not opened books for second quarter delivery. Premium prices are being paid for prompt shipment.

Nuts, Bolts and Rivets

Pittsburgh, Dec. 5.—No change is noted in prices of nuts, bolts and rivets at Pittsburgh. Demand for all three products is described as heavy and some makers predict that quotations will be put up at an early date.

Plates Sold Far Ahead

Leading Eastern Company Quoting for Delivery in Last Quarter of Next Year at Five Cents Per Pound—Ship Plates Higher

Philadelphia, Dec. 4.—Some of the eastern plate mills now have sold themselves into a position where they are practically out of the market for many months except on universals, where they can take on moderate amounts for three to four months' delivery. One leading maker advises that it can handle no important tonnage of tank on grades other than universals before the last quarter of 1917. Another smaller eastern mill is out of the market until well into the third quarter. This is the usual position of eastern mills, and it is rather surprising that one large independent producer announces that he has a considerable tonnage of tank still open for the first quarter of next year. This maker has been taking on some contracts for tank, sheared and universal, for the first quarter on which he advanced in the week from 4c to 4.25c, Pittsburgh. For the second quarter, however, he asks 4.75c, base, Pittsburgh, as he does not desire to sell freely that far ahead. Other eastern mills show a variety of prices on tank steel. One quoted 4c, Pittsburgh, on universal and 5c on sheared; another wants 4.50c minimum on sheared. Nothing under 4c is to be noted. Car builders are in the market for much tonnage.

The Pennsylvania railroad this week distributed among several mills about 15,000 tons of car plates for the quickest delivery possible at Altoona. Ship plates are very strong and scarce for anything except very deferred deliveries. An eastern maker this week delivered several thousand tons for April-May offered at 5.50c, Pittsburgh. A Pacific coast yard is offering about 7,000 tons for three boats. There is much export inquiry for ship plates, a large part of which is being declined. Ship plates are held by eastern mills at from 5c to 6c, Pittsburgh. For marine boiler plates one producer's minimum price is 12.40c, Pittsburgh, and small sales have been made at 14.40c, Pittsburgh.

Large Hull Tonnages

New York, Dec. 5.—Awards by the navy department of two battleships to the Newport News Ship Building & Dry Dock Co., and two to the New York Ship Building Co., are being followed by the distribution of about 70,000 tons of hull material to the steelmakers. Each of these vessels will require about 17,500 tons of hull material. The Carnegie Steel Co. will furnish all the steel for the two vessels to be built by the Newport News company and will divide with the Cambria Steel Co. that required for the two ships to be built at Camden. The portion of the Cambria Steel Co. will amount to about 5,000 to 10,000 tons of ordinary hull material. Another large requirement of structural steel, approximately 75,000 to 80,000 tons, for the four battle cruisers soon will be up for distribution, as bids on these war craft are due this week. Each cruiser will require about 18,500 tons. An export buyer, who has been in the market for 15,000 tons of ship plates, has manifested a willingness to pay 5.25c and 5.50c, tidewater. On 1,500 tons, 6c, tidewater, was quoted.

Car Buying Active

Pittsburgh, Dec. 5.—It is estimated that fully 30,000 steel freight cars were purchased by railroads in November. Demand for car material is so heavy that some mills virtually have withdrawn from the market. Car builders who complained about paying 1.50c for plates not many months ago, now are offering to pay 3.25c and above. The Carnegie Steel Co. is quoting plates at 3.50c for delivery at its convenience. Some mills are asking 4c and above for shipment within 90 days.

For Delivery in a Year

Cleveland, Dec. 5.—A leading eastern plate manufacturer is now quoting 5 cents, mill, or 5.204c, Cleveland, for sheared plates for delivery in one year. The same company is quoting 4c for early delivery of universal plates and 6c for ship plates. Cleveland companies are quoting 4.50c as the minimum on plates and No. 10 black sheets.

Machine Company

The Globe Machine & Stamping Co., W. 76th street, Cleveland, has had plans prepared for a new storage plant to be erected on a site adjoining the present plant. The building will be in the form of a triangle with a 200-foot hypotenuse. Each of the other walls will be 120 feet long. The building will be three stories and has been estimated to cost $15,000. The contract has been let to the H. G. Slatmyer & Sons Co., Cleveland. Upon the completion of the storage building, an L-shaped structure to relieve manufacturing congestion, will be erected. Each of the arms will be 200 feet long. The 120-foot walls of the storage building will serve also as the walls in the apex of the new building.

(For complete prices see page 1178.)

Steel Pipe Prices

Have Been Advanced $4—Iron Pipe Also Marked Up

Pittsburgh, Dec. 5.—The Wheeling Steel & Iron Co., the Youngstown Sheet & Tube Co. and several other independent manufacturers, on Dec. 1 advanced prices of standard steel pipe two points, or $4 a ton. Under date of Dec. 4, the National Tube Co. sent out cards showing similar advances in prices of all sizes of standard black and galvanized butt and lap welded pipe and proportionate advances were made in prices of oil country goods, including tubing, casing, line and drive pipe. The A. M. Byers Co. has distributed new cards showing similar advances in prices of wrought iron pipe.

Since Jan. 1, 1916, 12 changes have been made in prices of steel pipe. Butt welded black pipe has advanced 11 points, or $22 a ton; lap welded black pipe has advanced 14 points, or $28 a ton. Butt welded galvanized pipe has advanced 10 points, or $20 a ton and lap welded galvanized pipe 12 points, or $24 a ton. Manufacturers of wrought iron pipe have made advances in prices similar to those affecting steel pipe.

Several attractive inquiries are pending, but mills do not seem able to meet specifications for delivery. The Philadelphia Co. today placed contracts for 20,000 tons of iron and steel pipe for its first half requirements. The company bought 12,000 tons of iron pipe and 8,000 tons of steel pipe. Boiler tubes, which were advanced in price about 10 days ago, were not affected by price advances made by manufacturers of standard pipe.

Moves to Toledo

Desiring to be near its important customers, the Doehler Die Castings Co., with main offices and plant in Brooklyn, N. Y., has moved the department devoted to the manufacture of brass backed babbitt lined bearings, which are made expressly for the automobile trade, to Toledo, O. An addition was built to accommodate the new department which added about 25 per cent to the plant. Plans are being discussed for enlarging the rest of the factory.

Fair Advance

Of Structural Material Made by Railroads—New Buildings

New York, Dec. 5.—Another bunch of railroad offerings calling for 7,000 to 8,000 tons, has appeared in the fabricated steel market, making the total railroad work now pending in eastern territory approximately 20,000 tons. Some fair awards are being made by the railroads, including a total of 4,500 tons recently by the Southern. Ship yard extensions remain the source of a large prospective tonnage. It now is estimated that the government's requirements for the League Island navy yard, Philadelphia, will be from 10,000 to 12,000 tons, and a considerable tonnage also will be needed at Norfolk. The fabricated market, as leading interests put it, shows plenty of work for the present capacity of the shops, which is affected seriously by problems of material supplies, labor shortages and inefficiency, freight embargoes, etc. J. P. Morgan & Co. remain in the market for a considerable tonnage of beams and angles for France. Plain shapes now generally are quoted by eastern mills at 3.25c, Pittsburgh, or 3.419c, New York, with some other makers still unchanged at 3c, Pittsburgh.

Plant Extensions Keep Mills Busy

Pittsburgh, Dec. 5.— Fabricating shops in the Pittsburgh district are turning out heavy tonnages of material for additions and extensions to industrial plants in all sections of the country. Demand for steel for mill buildings is heavier than at any time in the history of the trade. Such concerns as the Youngstown Sheet & Tube Co., the Pittsburgh Crucible Steel Co., Corrigan, McKinney & Co., the American Rolling Mill Co., the Brier Hill Steel Co. and the Trumbull Steel Co. have either built or are building large extensions to their plants, involving from 2,000 to 6,000 tons of fabricated material.

The Carnegie Steel Co. is quoting structural shapes at 3c for delivery at its convenience. For early shipment, premium prices are being asked by manufacturers in a position to meet specifications for delivery.

Prices Advancing

Philadelphia, Dec. 4.—Greater tightness is shown in the supply of structural shapes available from eastern mills and the difficulty of buyers to secure this material is holding back some work. This has been true among the car builders who have found that it is easier to get desired deliveries on tank and universal plates than on shapes and accordingly they are more anxious to place these orders together. The eastern shape market moved up to this week to a uniform basis of 3.25c, Pittsburgh, or 3.409c, Philadelphia, which one producer adopted a week ago. A large eastern Pennsylvania maker advanced from 3.15c to 3.25c, Pittsburgh, and an important western Pennsylvania independent from 3c to 3.25c, Pittsburgh. The latter put ship shapes at 3.75c, Pittsburgh. Active obligations still take up the output of eastern mills for many months distant and the latter are more careful in making new sales, though numerous tonnages are being offered for such delivery as the producer can make. In isolated cases, contracts through the third quarter have been accepted at current prices. A 15,000-ton shape inquiry for British buyers still is pending. It develops that on a considerable part of the large tonnage of beams for France, J. P. Morgan & Co. paid 3.50c, Pittsburgh.

Keen Competition

Cleveland, Dec. 5.—In spite of the great prosperity prevailing and the advancing trend of prices for finished materials, there is keen competition among fabricating and erecting companies and on recent business, it is understood that prices for steel erected have varied fully $20 per ton. The contract for the new plant of the National Malleable Casting Co., 3,200 tons, has been awarded to the McClintic-Marshall Co. The contract for the new building of the National Pressed Steel Co., Massillon, O., manufacturer of hot and cold rolled strip steel, which will require 500 tons, will probably be awarded this week.

Structural Buying Limited

Chicago, Dec. 5.—Buying of structural shapes in the west seems to be limited still further and the present week finds only a few projects closed. The most important from a tonnage point of view involves 1,600 tons for a lift bridge over the Chicago river, which will be fabricated by the American Bridge Co. for the Illinois Central railroad. Other tonnages involve a bridge and two industrial structures. A further advance in mill prices is expected to be announced within a short time.

CONTRACTS AWARDED.

National Acme Machinery Co., Cleveland, addition, 2,400 tons, McClintic-Marshall Co. The Austin Co., Cleveland, has the general contract.

New plant National Malleable Castings Co., Cleveland, 3,200 tons, McClintic-Marshall Co.

Rothchild building, Baltimore, 250 tons, to Dietrich Bros.

Various buildings including engine house for the Bethlehem Steel Co. at Sparrows Point, estimated at about 2,500 tons, general contract for Irwin & Leighton. Bethlehem Steel Co. to furnish plain material.

Additional bridges for Southern railway, about 2,000 tons, making recent awards to this fabricator about 4,500 tons, to American Bridge Co.

Extension to the Harrison, N. J., plant of the Crucible Steel Co., 2,500 tons to the American Bridge Co.

United States Alloys Co., Niagara river, near Buffalo, new plant, general contract to Lackawanna Bridge Co., 200 tons.

Illinois Central Railroad Co., St. Charles Air Line lift bridge over Chicago river, 1,600 tons, to American Bridge Co.

Utah Copper Co., conveyor supports for leaching plant, Arthur, Utah, 275 tons, to Kansas City Structural Steel Co.

Goodman Mfg. Co., factory building at Chicago, 236 tons to Hansell-Elcock Co.

CONTRACTS PENDING.

New plant National Pressed Steel Co., Massillon, O., 500 tons, probably be awarded this week.

Extension to shops of Baldwin Locomotive Works, Eddystone, Pa., 500 to 1,000 tons, bids being taken.

Bridge work for the Maine Central railroad, 2,200 tons, bids being taken.

Bridge work for the Baltimore & Ohio railroad, 700 to 800 tons, bids being taken.

Addition to the Hotel Woodward, Broadway and Fifty-fourth street, New York City, 1,800 tons, bids being taken.

Kempner loft building, 416 Fourth avenue, New York, 700 to 800 tons, bids being taken.

Garage, 32-34 West Sixty-sixth street, New York City, for the Wm. J. Taylor Co., 200 tons, bids being taken.

Pier shed, Baltimore, for the Baltimore & Ohio railroad, 3,000 tons, bids being taken.

The Fenwick Club building, Cincinnati, 10 stories, steel frame work, cost $250,000, 800 tons.

(For complete prices see page 1178.)

Rail Buying

For Delivery in 1918 Continues—Some Taken by Colorado Company

Chicago, Dec. 5.—Buying of standard steel rails for 1918 delivery is going forward in a satisfactory way. Inquiries have been received by rail makers from practically all important lines in the west and a large portion of this business already has been placed in contracts, the total running close to six months ordinary production. However, deliveries have been spread over the year to meet convenience of both mill and producer, so that some of the tonnage will not be delivered until September, 1918.

Some of the present business is being booked by the Colorado mill, which is understood to be making approximately the same price as competitors further east. Prices on track

Some orders already placed which have just come to light include 2,000 gondola cars for the New York Central, placed with the Standard Steel Car Co., 500 hoppers for the Delaware, Lackawanna & Western, which will be built by the American Car & Foundry Co. The Norfolk & Western railroad is asking for 2,000 hoppers and 1,000 box cars

Has Scrap Touched Top?

Is Question Agitating Dealers in Some Centers. But in Most Places Prices Still Advance

Cleveland, Dec. 7.—Although some heavy selling has been going on again during the past seven days, even in larger volume than last week, the market keeps strong. Some indications of a feeling among dealers that the market for some of the melting steel grades may have reached the top have come to the surface, and the immediate future of their prices lies wholly in the way further purchasing will be done. If heavy demands continue to come out from consumers, prices may rise, but in the absence of such new demands, the opinion is current that the present level will be adhered to. The expectations of the most hopeful sellers in the market have been attained.

Foundry grades are now taking on gains as the attention is directed from the steel mill grades. Cast scrap, malleable and steel foundry scrap are notably strong, and possibly advances in prices will continue to come out.

Sales of thousands of tons of cast iron borings and steel machine shop turnings have been made to blast furnace operators in the Pittsburgh and valley districts at prices that keep rising. Fear of a shortage of iron ore was the cause of a great proportion of such purchases, and, too, these grades were at least $6 below their normal prices, and were well worth buying for use.

Advancing at Cincinnati

Cincinnati, Dec. 5.—The iron and steel scrap market is featured by sharp advances on all grades, except machine shop turnings, cast borings and heavy turnings. These three were advanced last week and are holding unchanged. Machine shop turnings are quoted from $8.50 to $9, and cast borings from $8 to $8.50, both per net ton. Heavy melting scrap is given from $20.50 to $21.50 per gross ton.

Chicago Rise Continues

Chicago, Dec. 5.—Continued advance is the rule in the iron and steel scrap market in Chicago and present levels on many items are almost unbelievable in the light of previous experience. A sale of heavy melting steel to a local consumer within the past week is said to have been on a basis of $23.50 to $24, delivered. Other forms of steel for similar use are at corresponding prices. Rerolling rails have advanced to practically $30 per ton, and there is considerable scarcity of this product.

Further Advances Made

Buffalo, Dec. 5.—Further advances in a number of the leading commodities in the scrap list have taken place in the past 24 hours. Heavy melting steel is being quoted at $22 to $22.50. Dealers say it is scarce and that no large tonnages are available to meet the demands of consumers. There is a particularly strong demand for turnings and borings, both being quoted now at $10.50 to $11. A sharp advance in the price of old car wheels is noted, the price at present being nominally at $20.50 to $21, while a sale of 10,000 tons at $24 is reported.

Scrap Prices Firm

Pittsburgh, Dec. 5.—Old material disposed of this week by the Baltimore & Ohio railroad and the Pennsylvania railroad commanded high prices. The bulk of the tonnage was purchased by consumers. Heavy melting steel is commanding as high as $25 a ton, and low phosphorus scrap is selling at above $30 a ton. Not much low phosphorus stock is being offered in this district. Rather heavy tonnages of turnings and borings are being sold for delivery the first quarter of 1917. Blast furnace managers have been active buyers of both grades.

According to some people in close touch with the situation, the market for scrap will mark time for a week or longer. Consumers have enough tonnage on hand to meet requirements for several weeks.

M. Speer Iron & Metal Co. has closed its offices at Youngstown, O., and opened an office at 310 Hammory building, Sharon, Pa. The firm has also opened a yard at Sharon, Pa.

Trend Still Upward

Philadelphia, Dec. 4.—The upward movement in old material prices in eastern Pennsylvania continues, as the buying is active and well distributed. One steelmaker closed for several thousand tons of heavy melting steel at $24, delivered, but the market is higher now. The purchase of steel at rising prices at Pittsburgh and Johnstown is tightening the eastern market by attracting some tonnage from neutral points. The Bethlehem Steel Co. again has been a liberal buyer of borings and turnings and prices of these grades are up $1 to $2 as a result. Sales of No. 1 railroad wrought have been made at $26, delivered, and higher is reported. Shafting has been sold at $29, delivered.

Still Moving Upward

St. Louis, Dec. 4.—Scrap prices are advancing still, and there appears to be no end to the upward movement. Scarcely any two transactions for the same grade of material are at the same price. The shortage of scrap is not confined to any one class, as there is insistent demand for all grades which are being supplied owing to the light railroad offerings. Inquiries for rerolling rails and cast iron car wheel are coming into this market from Pittsburgh and other districts, and this fact is causing these grades to advance more rapidly than the remaining one. There are no railroad offerings this week of any consequence.

Increasing Shortage

Birmingham, Ala., Dec. 4.—The old material market has shown a substantial advance during the week. Dealers in general report an increasing shortage of all grades of scrap, consequently are able to sell for spot delivery only. Some of the dealers are selling only as they are able to get the scrap loaded on cars, or have it sorted ready for shipment from their yards. The short supply creates a too speculative condition for forward delivery. Practically all the steel scrap has disappeared, and consumers are looking to other fields for their supply, or else purchase low grade pig iron of desired analysis.

(For complete prices see page 1178.)

Spikes Advanced

Chicago, Dec. 5.—Railroad spikes were advanced today from 3c, Chicago, to 3.50c, Chicago. Small spikes were advanced to 3.60c, Chicago. This advance is the second within a short time, as railroad spikes were selling a short time ago at 2.75c to 2.90c, Chicago. Track bolts have not been advanced recently, and remain at the former quotation of 4.25c to 4.50c, Chicago.

Many Cranes Sold

The Brown Hoisting Machinery Co., Cleveland, has closed contracts to make 90 cranes of various types for widely distributed concerns throughout the United States, and has placed orders for the steel to be used in their manufacture. Inquiries for 70 cranes for export are pending.

The Sharon Steel Hoop Co., Sharon, Pa., has notified its employes that their wages will be increased 10 per cent. The Valley Mold & Iron Co., Sharpsville, Pa., has announced a similar increase in wages.

Great Record

Made in the Shipment of Ore—Loading Still in Progress

Cleveland, Dec. 5.—Lake Superior iron ore shipments for the 1916 season to Dec. 1 make the tremendous total of 63,648,298 tons, an increase of 17,386,730 tons over the tonnage shipped during the same period in 1915 and 14,577,820 tons more than the total tonnage shipped in the entire year 1913, which up to this year held the record. The weather during the past few days has been very favorable for ore loading and leading independents expect to continue loading up to Dec. 12. It is believed that the Steel Corporation will do little, if any, more loading this year, but the movement for December may reach 1,000,000 tons and the all-rail shipment for the year is likely to be fully 1,000,000 tons. Hence it will not be surprising if the entire movement for the season amounts to 66,000,000 tons. The shipments in November this year and last year, and for the entire season to Dec. 1, this year and in 1915, were as follows:

Port.	November, 1915.	November, 1916.
Escanaba	696,346	772,417
Marquette	263,386	273,801
Ashland	451,020	665,339
Superior	958,465	1,132,642
Duluth	1,328,848	1,982,872
Two Harbors	747,064	888,381
Total	4,445,129	5,715,452
1916 increase		1,270,323

	To Dec. 1, 1915.	To Dec. 1, 1916.
Escanaba	5,636,427	7,279,899
Marquette	3,099,589	3,820,452
Ashland	5,146,772	7,935,185
Superior	8,307,381	12,626,473
Duluth	15,437,419	21,455,345
Two Harbors	8,633,980	10,530,944
Total	46,261,568	63,648,298

Many Wage Advances

More wage increases are announced this week, chief among which is a 10 per cent advance, affecting nearly 40,000 men, by the Bethlehem Steel Corporation's plants at South Bethlehem, Steelton and Sparrows Point. The increase is effective Dec. 16, as is also an advance announced by the Central Iron & Steel Co. to the 1,200 employes of its plant at Harrisburg.

Will Make Strip Steel

New York, Dec. 5.—J. V. W. Reynders, of New York, formerly vice president of the Pennsylvania Steel Co., in charge of operations at Steelton, has become chairman of the board of the American Tube & Stamping Co., Bridgeport, Conn., control of which recently passed to new hands. It is proposed under the new management to extend considerably the production and operations of the plant, and the first step in this direction will be the enlargement of the present open hearth department, which consists of four furnaces. Several additional furnaces will be installed and later it is probable that the present rolling capacity also will be extended. For the present, however, the company will continue to specialize in the production of cold-rolled strip steel.

President Jacobus

Addresses Society of Mechanical Engineers at Opening Meeting

New York, Dec. 5.—The thirty-seventh annual convention of the American Society of Mechanical Engineers was opened here tonight with an address by the president, Dr. D. S. Jacobus, on "Education in Engineering". Following this address and the introduction of the president-elect, Dr. Ira N. Hollis, the society tendered a reception to the officers. A business meeting is scheduled for tomorrow, following which, the first professional session will be held. The convention will adjourn on Friday, although the public hearing of the boiler code committee, to begin on Friday, will be continued on Saturday.

In his address, Dr. Jacobus advanced the contention that much work that now is included in a college engineering course probably could be eliminated with advantage, provided that care be taken to teach the fundamentals. Once thoroughly mastered, the student will carry with him the foundations of physics and mechanics, whereas much that relates to special applications will be forgotten. In place of the work dropped, Dr. Jacobus suggested, the engineering student should receive instruction in the art of speaking while on his feet, of couching reports in an interesting and grammatical style, and he should be schooled in economics, the law of contracts, etc., in order that he thus may have a thorough grasp of the essentials to success in engineering, not only from the practical but the business standpoint. Dr. Jacobus expressed the belief that the standard of college entrance requirements is too high, resulting in discouraging many men who have had much practical experience and who with the proper knowledge of the fundamentals would become unusually successful engineers. Instead of the customary entrance examinations, Dr. Jacobus advised that each applicant be given an oral examination before a board which should judge the qualifications of the individual in each case.

Dr. Jacobus alluded to replies received by the Carnegie foundation for the advancement of teaching in its effort to determine the qualities which are most desirable in a teacher. These replies indicated that character and personality, and the qualities of initiative, responsibility, integrity, judgment, scientific attitude, accuracy, perspective, efficiency, industry, understanding of men and executive ability, are appreciated more highly than knowledge of the fundamentals of engineering science and the technique and practice of business. He thought this list laid too little stress on knowledge, saying he knew many a man who has noble qualities and is a prince at heart, but who has missed his chance because of lack of knowledge. Dr. Jacobus mentioned as essential to success, the qualities: "Taking a personal interest in your work, amenability to discipline, perseverance under adverse circumstances and cheerfulness."

"The making of experiments carries with it great danger," said Dr. Jacobus. "A professor should not be permitted to endorse commodities where the idea is simply to obtain his name, or worse than this, the name of his college, for use in advertising matter, nor should he permit his name to be used in connection with tests which may be of more value to salesmen than to the engineering profession. Above all, he must be careful in his reports and in his testimony as an expert not to bring discredit to his profession and his college by departing a hair's breadth from the truth, or by testifying in a way which will evade the truth."

New Coal Rates

The Pennsylvania railroad has voluntarily put into effect what is known as the Westmoreland freight rates on coal for eastern shipment from the Connellsville regions. Mines on the Monongahela branch of the Pennsylvania system after Jan. 1, will enjoy the same freight rates as those now applying to the Westmoreland district. At present, the Westmoreland district enjoys a differential of 15 cents a ton for eastern shipment.

Advances at Detroit

Detroit, Dec. 5.—Warehouse prices on steel and iron bars, shapes and plates have been advanced $5 per ton. Prices on sheets have been advanced as follows: No. 10 blue annealed, $9; No. 28 black, $8; No. 28 galvanized, $20. Quotations are now: Steel and iron bars, 3.60c; shapes, 3.70c; plates, 4.35c; No. 10 blue annealed sheets, 4.25c; No. 28 black sheets, 4.50c; No. 28 galvanized sheets, 6.50c.

(*For complete prices see page* 1178.)

Demurrage Rates

As Readjusted Are Hoped to Relieve Car Situation

Washington, Dec. 5.—Readjusted demurrage rates formally ordered by the interstate commerce commission last Friday are being looked to with the expectation that they will be of substantial aid in relieving the present situation as to car shortage. The new rates, ordered to become effective at once upon filing, represent advances over the old rates and because of this it is expected that shippers will unload freight cars as quickly as possible and release them before they will be penalized by paying the higher charges. The commission's order directed the railroad to cancel all proposed demurrage schedules, which had been suspended on protest from shippers, and authorized filing of new schedules, first, making no change in the present effective form of the weather rule or average agreement; second, providing for two days' free time, exclusive of Sundays or legal holidays, and following the following rates after the expiration of free time:

One dollar for third day; $2 for fourth day; $3 for fifth day, and $5 for sixth day and each day thereafter.

The new rates, to apply until May 1, 1917, are a compromise between the old ones and those proposed by the carriers, the latter providing the following charges after two days' free time:

Two dollars for third day; $3 for fourth day; $4 for fifth day, and $5 for sixth day and each day thereafter, with the weather rule eliminated and the average agreement modified.

Railroads all over the country having a surplus of freight car equipment on their lines are directed in orders issued by the conference committee on car efficiency of the American Railway Association to return specified percentages to junction points. The committee has announced that railroads in New England which have on their lines more box cars than they themselves own, must turn over to their southern and western connections 30 per cent more box cars than they receive from those lines. Railroads in what is known as trunk line and central freight territories, regardless of the number of box cars on their lines, must deliver to their southern and western connections 20 per cent more box cars than they received from them. Southern and western roads, regardless of the number of box cars on their lines, must deliver to their southern and western connections 10 per cent more box cars than they receive, while lines in the central west must deliver 20 per cent more box cars to their southern and western connections than received from them.

This action, the committee believes, will force a large number of box cars to the west, northwest, south and southwest, where there is urgent need for them.

Foreign Trade

Will be Discussed at Group Sessions of Pittsburgh Convention

The fourth national foreign trade convention, to be held in Pittsburgh, Jan. 25, 26 and 27, will be essentially a business men's conference. Instead of a program consisting completely of prepared addresses, much of the time will be reserved for "group sessions", at which a single topic will be intensively discussed by the question-and-answer method so successful in the previous foreign trade conventions at Washington, St. Louis and New Orleans. Among the topics set for discussion are:

1. Conditions in foreign markets after the war, including the European economic alliances, and the measures necessary to safeguard American foreign trade, as well as the foreign trade aspect of the American tariff system.
2. Co-operation in foreign trade: The necessity for the relief of exporters from the restrictions of the anti-trust laws, which now oblige them individually to meet combinations of foreign rivals encouraged by foreign governments to resist American competition, and often to sell to combinations of foreign buyers equipped to depress the price of American products.
3. Shipping: Foreign investment of American capital in its relation to over-sea commerce.
4. Problems of the smaller manufacturer: How this class of industries, producers and merchants may more effectively enter foreign markets.

Many other phases of the foreign trade problem will be on the program now in course of preparation.

Those interested may obtain further information as to the conditions of invitation by addressing Robert H. Patchin, secretary, National Foreign Trade Council, India House, 1 Hanover Square, New York City. A registration fee of $5 is paid by all participants.

Coke By-Products

Active Buying of Benzol and Toluol—Prices Steadier

New York, Dec. 5.—Active buying is continuing in benzol and toluol for both early and forward positions and prices exhibit more steadiness. The buying around the present level of prices has been heavier than the market has witnessed for some time and producers are inclined to hold more firmly their unsold portions of future supply. In toluol, after a week of activity for both contract and spot delivery, involving some large quantities, some leading sellers state their output is practically cleaned up for the first half of next year and a considerable portion of the second half production also has been engaged. The domestic powder manufacturers have been buying toluol heavily and there have been some large export sales to foreign governments. Prices in benzol, toluol and phenol are unchanged this week. Contract toluol, which recently has been sold considerably under $2 per gallon, on large lots, looks firmer around $2 owing to the reduced supplies now available for sale. Benzol is quoted from 55 to 60 cents. Offerings of phenol continue more restricted owing to heavy recent sales and as a good demand still is current, the market is very strong at from 50 to 55 cents, both for spot and contract. A number of good-sized contracts have been put through in solvent naphtha, but this has not strengthened the market, which remains weak due to the liberal unsold supplies.

The rise in sulphate of ammonia is uninterrupted under the nearby demand which exceeds the obtainable supplies. Prices this week are up 3 cents to $3.95 to $4 per 100 pounds, at tidewater. Sellers are obliged to reject considerable business, even from their regular customers. Price quotations are as follows:

Market Prices for Coke Oven By-Products

Spot.

Per Gallon at Producers Plant.	
Pure benzol	$0.55 to 0.60
Toluol	2.50 to 3.00
Solvent naphtha	.25 to .30
Per Pound at Producers Plant.	
Phenol	$0.50 to .55
Per 100 Pounds at Seaboard.	
Sulphate of ammonia	$3.95 to 4.00

Contract.

Per Gallon at Producers Plant.	
Pure benzol	$0.55 to .60
Toluol	2.00
Solvent naphtha	.25
Per Pound at Producers Plant.	
Phenol (nominal)	$0.50 to .55
Per 100 Pounds at Seaboard.	
Sulphate of ammonia (nearby)	$3.95 to 4.00

The plant of the American Foundry & Mfg. Co., St. Louis, was damaged by fire to the extent of $10,000 on Dec. 1.

Cast Iron Pipe

Higher Prices in South—Advance Expected at Chicago

Chicago, Dec. 5.—Although the price of cast iron pipe has been advanced $8 per ton within the past month it is believed a further advance will be announced within a short time. This increase in price is an effort to keep pace with the rapid advance of pig iron, which has gone forward even more rapidly.

Municipalities are beginning to place their inquiries in the market for such tonnages as they absolutely need for extensions during 1917. In many cases, this work is being kept within as narrow bounds as possible on account of present unusual prices. Bids were to be opened at Eveleth, Minn., Dec. 5, on 1,250 tons, at Ann Arbor, Mich., Dec. 6, on 1,100 to 1,300 tons, at Erie, Pa., Dec. 6, on 600 tons, and at Toledo, O., Dec. 12, on 1,500 tons. The city of St. Paul has awarded 425 tons to the United States Cast Iron Pipe & Foundry Co.

Quoting Conservatively

New York, Dec. 5.—Eastern makers of cast iron pipe, in view of rapidly-changing schedules due to pig iron market conditions, are making quotations very conservatively, even at advanced prices. They are insisting that a quotation shall not be left open more than two or three days and they are declining to quote deliveries beyond two or three months. Buying by private consumers is fairly active and some of these users want deliveries into late next year. Public lettings are few. The export field shows some new developments, including the award of 1,000 tons of 6 to 14's to the United States Cast Iron Pipe & Foundry Co., for Havana. A new inquiry for the east coast of South America calls for about 3,000 tons of 7 to 13's. Honolulu wants 200 tons.

Waterworks Supplies

Toledo, Dec. 4.—Bids will be opened on Dec. 12 for the following supplies for the waterworks department of the city of Toledo: One thousand tons of sulphate of iron, 3,500 corporation cocks, 4,000 curb cocks, 50 tons of lead, 100 tons of lead pipe, 2 tons of solder, 2,500 curb boxes, 225 hydrants, 1,530 tons of cast iron pipe, 30 tons of pipe specials, 210 valves, 5,210 water meters. It is estimated the cost will be from $100,000 to $150,000.

Prices Marked Up

Birmingham, Ala., Dec. 4.—The cast iron pipe market has shown further improvement during the week and prices have advanced. Notwithstanding the advance in prices, manufacturers report that there has been practically no halt in purchases and that considerable new business is being placed on their books. All of the southern plants of the pipe industry have closed for a substantial tonnage of iron as far ahead as sellers were willing to carry their purchases. Following prices per net ton f. o. b. cars at the plants are quoted: Four to 6-inch, $37; 6-inch and up, $34, with $1 per ton extra for gas pipe, and 16-foot length pipe.

Billet Supply

Is Limited—Increased Inquiry for Steel in Ingots

Philadelphia, Dec. 4.—An interesting aspect of the present acute scarcity of semi-finished steel is the increased inquiry from consumers for metal in ingot rather than in billet or bloom form. The buyers, by taking ingots, apparently hope to get the advantage of a larger supply of crude steel since some of the eastern mills have more steelmaking than blooming capacity. Some of the latter consequently have been sellers of ingots upon which prices equal to those for billets are obtainable. One buyer in the territory has offered $75, mill, for 22-inch forging ingots. A Camden forging plant is in the market for a tonnage of ingots. Billets are very scarce and the inquiry constantly is large, so that eastern mills are forced to decline considerable business. Eastern makers nominally quote open-hearth rolling billets at $55 to $60 and forging billets at $60 to $70, mill. Shell steel crops are stronger. One large maker is holding its monthly output at $45, mill. A large eastern Pennsylvania producer, after recent export sales at $37.50, mill, is not offering.

High Prices at Cleveland

Cleveland, Dec. 5.—Sheet bars have been sold in Cleveland within a few days at $65 and forging billets at $75. The demand is active and the supply limited.

Scarce at Any Price

Youngstown, O., Dec. 5.—A weekly report of the sheet bar market in this territory has become a matter of quoting last week's maximum as this week's minimum. Last week's high was $60. It is doubtful whether any tonnage is being sold in the Mahoning Valley this week even at that price, and $65 is the maximum. Some of the buyers say they are unable to get tonnage at less than $62. These are the current quotations, but the sheet manufacturer who is able to buy bars at any price considers himself fortunate. Few of them are able to get enough bars to enable them to operate more than 75 per cent of full time.

The Non-Ferrous Metals

Copper **Lead** **Spelter** **Tin**

New York, Dec. 5.—Advancing prices in copper again featured the metal markets during the past week. Buying as a whole was not of large proportions, but nevertheless, the demand increased sufficiently to again boost quotations all down the line. Supplies in this market remain exceedingly scarce. None of the leading selling agencies, so far as is known, has any copper for delivery before the third quarter of 1917, and metal is difficult to obtain in any source before that time. Electrolytic quotations today are as follows: Prompt, December and January, 34.50c to 35c, cash; February and March, 34c to 34.75c, 30 days; second quarter, 33.50c to 34c, 30 days; third quarter, 31.50c to 32c, 30 days. Lake and casting copper prices are somewhat easier and are holding as follows: Lake, Prompt, December and January, 33.75c to 34c, 30 days; February and March, 33c to 33.50c; second quarter, 32.50c to 33c, 30 days; casting copper, Prompt and December, 32.50c, cash; and January, 32c to 32.25c, cash.

The long expected advance by the American Smelting & Refining Co. materialized today, when the company's official asking price on lead was raised from 7c to 7.50c, New York. Following this action by the leading seller, outsiders immediately boosted their quotations to a range of 7.50c to 7.62½c, New York; and 7.42½c to 7.50c, St. Louis. Buying in this market during the past week has not been of large proportions.

The spelter market is in the hands of the second sellers, who are offering prime western at low figures. Yesterday there were offers of December at 12.75c, St. Louis, and first quarter at 12.50c. Today December was offered at 12.37½c, and first quarter at 12.25c. So far as known there were no sales. The producers are not participating in the low offers.

The tin market is declining due to declines at London and to the unfavorable statistical position of the metal outside of this country. Practically no business has been reported the last few days. Spot Straits is quoted at 44.37½c to 44.50c, and spot Banka, which is scarce, at 44c to 44.12½c.

The market on prompt and nearby aluminum is somewhat firmer. No. 1 virgin ingots in carload lots are quoted at 64c to 66c, No. 1 remelted at 58c to 60c and No. 12 remelted at 45c to 46c.

The antimony market is dull. Spot is quoted at 14.50c, duty paid, and December and January shipment from China at 13.50c, in bond.

(For complete prices see page 1178.)

MORE than 30 papers, representing the work of competent men in various fields are included in the program for the thirty-seventh annual meeting of the American Society of Mechancial Engineers at New York, Dec. 5 to 8. The authors of many of the papers have gained prominence in their engineering and professional activities, and those who have contributed to the program for the first time have been engaged in important work that enables them to speak authoritatively. A number of the papers dealing with subjects of interest to men in the iron and steel industry are presented in this issue of *The Iron Trade Review,* and others will be published in following issues.

The principal professional feature of the meeting is the discussion of the valuation papers presented at the Thursday sessions. The subject of valuation, as it applies to industrial properties, has been widely discussed owing to the complications arising from the rapid changes that are now taking place in the economic aspects of industry in this country. The problem of correctly determining values is of basic interest to engineers, but previous to this meeting it has received little collective attention.

Accurate Appraisals by Short Methods

John G. Morse, chief appraiser of the Associated Factory Mutual Fire Insurance companies, presents in a paper entitled "Accurate Appraisals by Short Methods", methods that have been developed from 15 years' experience in making appraisals of industrial plants. Mr. Morse shows that in many cases an effort to go into details will bring about unsatisfactory results. The grouping of buildings, machines, and other items according to the author's suggestion provides an easy means for determining the approximate value.

Relation Between Perpetual Inventory Value and Appraisal Value

Charles Piez, president and treasurer of the Link Belt Co., Chicago, in a paper bearing the above title, shows that the appraisal value is only supplementary to the perpetual inventory value. He points out the discrepancies usually existing between the values based on inventory and appraisal, and indicates how the two methods may be safely employed. Included in the paper is a table of depreciation rates that were adopted by the Manufacturers Cost Conference, February, 1916.

Valuation of Industrial Properties vs. Valuation of Industrial Methods

Walter N. Polakov, who for 10 years has been engaged as consulting engineer on power plant operation and factory management, is the author of a paper which deals with the basis of valuation. He contends that when valuation is based upon a physical measure of the property, the cost of over-equipment and mismanagement is charged to the cost of the product. He claims that the revenue-producing factor in our mode of production is not the investment, but the method of its use. Mr. Polakov includes in his paper a concise review of the economic change in the United States caused by the war.

Productive Capacity a Measure of Value of an Industrial Property

Henry L. Gantt, an associate of the late Frederick W. Taylor in the initial stages of the development of the latter's system of industrial management, and for 10 years a consulting engineer of the highest rank, advocates as the basis of valuation the ability of a plant to accomplish the object for which it was constructed. In his paper, entitled, "Productvie Capacity, a Measure of Value of an Industrial Property", he states that when costs are figured on the basis of capacity, great activity immediately ensues to determine why machinery is idle, and to see what can be done to put it in operation. He deals with the idleness problem in a thorough manner.

The Utilization of Waste Heat for Steam Generating Purposes

Arthur D. Pratt, assistant to the advisory engineer of the Babcock & Wilcox Co., in a paper dealing

with the use of waste heat, presents a comprehensive survey of the development of waste-heat steam generating plants in Europe and America. He discusses the application of waste-heat boilers to open hearth, copper matte and copper refining furnaces, beehive coke ovens, and heating furnaces.

Accurate Appraisals by Short Methods

BY J. G. MORSE

IN EXPLAINING the method by which a large manufacturing plant can be accurately appraised in a very short time and with what seems like a comparatively small amount of work, I shall endeavor to show how useless it is to waste time on more laborious detail. It is an admitted fact that no appraisal can be made without incorporating many figures that are based simply on estimate. It is, therefore, needless to carry the detail in any direction where it will not add to the accuracy of the final result.

A Method of Approximation

I have been asked to explain the method developed by the appraisal department of the Factory Mutual companies. It is a method based entirely on the theory that if the larger factors are carefully appraised, the less important items may be estimated in groups. The property to be appraised is divided into two parts —buildings and machinery. The buildings are considered as empty structures. All elevators, piping, wiring and indeed anything that can be removed without altering the building, are classed under machinery. Attention might be called to the fact that in insurance appraisals, foundations and other underground work are ignored, but the method would be practically the same were they included.

Machinery is divided into machines proper, shafting, belting, piping, electric wiring and furniture and miscellaneous apparatus. Special small tools, dies, patterns, drawings, molds, lasts and any objects of similar nature that exist in large quantities in the plant under consideration, are treated independently. The subject "miscellaneous apparatus", as its name implies, covers all objects of minor value not easily classified under any of the other heads. The price values used for buildings and all the subdivisions of machinery are based on replacing new at today's market regardless of original cost and these price values are then depreciated as judgment dictates.

By the term "building" simply the empty structure is meant. In appraising the square foot of floor area is used as a basis. Many architects and engineers use a factor based on the cubic foot of contents, but it is floor area that gives manufacturing facility, and the figures thus obtained are also useful in other parts of the appraisal as will be shown later. As a ground work we use the tables prepared by Charles T. Main. These must, of course, be changed for different heights of stud, degrees of finish, thickness of walls, etc., and also for constant fluctuations in the market value of labor and materials. As new factors are obtained for reinforced concrete and other modern forms of construction, the tables form a guide for consistency as lengths and widths vary.

In appraising buildings the uselessness of extended detail is strikingly apparent. Those who have had occasion to call for bids are aware of wide variance in figures submitted. Suppose two identical buildings are constructed, one by the highest bidder and one by the lowest. They may differ in cost by more than $10,000. Is the actual cost of either a fair appraisal figure? An estimate based on the square foot of floor area that showed a figure half way between the extremes would give a much more reasonable value. The actual cost of foundations is far more unsafe to use for appraisal purposes. A building resting on extremely expensive foundations in quick-sand is worth no more than a duplicate building resting on a ledge. A fair estimate for the cost of sufficient foundations in average ground would be a better figure to use for either when appraising an industrial property.

Appraising Machines

It is customary to make a complete inventory of all fixed machines, not only producing machines but those used for power and for maintenance. This inventory also includes all elevators and cranes. There is no hard and fast rule, but the practice is to list everything, exclusive of furniture, small tools, etc., that has enough value to be worth considering separately. In making this inventory, the shortest description that will identify a machine is used. When ordering a new machine, detailed specifications are usually necessary, but to incorporate a long description in a list of machines simply confuses when searching for an item and gives no real aid in determining the value.

Having completed the inventory, it is a simple matter to appraise standard machines either directly from price lists or from data compiled from individual quotations and actual costs obtained when making other appraisals. Of course, all such prices are given in confidence and are used without the source of the information being divulged. In the same way machines built on order or by the owner can be appraised as data on similar machines accumulate. Allowance is made in all cases for the cost of freight, cartage and labor of erection. It should be understood that no prices are fixed arbitrarily by the appraiser. On the contrary, the figures are discussed with the owner or manager and as much assistance as possible obtained from their records.

Approximation on Minor Items

By figuring in detail representative lines of shafting, with couplings, hangers and pulleys included, various factors per lineal foot erected have been obtained. Experience soon teaches which factor to apply when examining lines of shafting in actual use. Opportunities are repeatedly presenting themselves to compare the results obtained with those of a detailed appraisal, and the accuracy of the approximate method is confirmed. The most satisfactory method by which belting may be rapidly inventoried is to measure the main belts by eye. The machine belts can then be classified in groups, as similar machines will require about the same amount of belting. Individual motor drives are lessening the amount of belting in a modern factory, and where the machines are scattered and the belts vary greatly, it is usually easier to list them by using eye measurement than to attempt to apply any shorter method.

It is probably needless to call attention to the fact that a detailed inventory of piping and pipe fittings would require an amount of time out of all proportion to that devoted to the remainder of the work. To obtain a short cut method has not been as easy as with shafting and belting, due largely to the fact that there is a

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much greater variety in the material to be considered and that much of it is hidden. The different uses to which the piping is put enable the appraiser to divide the subject into classes and these classes can be treated by different methods. Automatic sprinkler piping can be appraised at a price per sprinkler head or, by what amounts to the same thing, by a price per square foot of sprinkled floor area. This applies to the piping inside the buildings only. Steam heating where consistent throughout the plant, can also be appraised on a floor area basis. Where the amount of steam heat varies a price per lineal foot of coil or per radiator can be easily ascertained. The heating pipe in dry rooms, lumber dry kilns, paper dry lofts, etc., can be treated in a similar manner. Gas lighting is not common today, but where found can be appraised at a price per light. Where a building is provided with gas lights at frequent intervals, a factor per square foot of floor area can easily be estimated. The piping used for manufacturing purposes presents the greatest difficulty. The steam and water pipe in a steam power plant will vary little from a standard figure per horsepower of boiler rating. For long runs of covered steam pipe through rooms where there are few or no outlets, a price per lineal foot can be used.

Air piping, though quite extensive in modern machine shops, never amounts to more than a very small fraction of the value of the plant. The runs of pipe are easily followed and a factor per lineal foot or per machine supplied can be ascertained.

All machine shops contain an equipment of small tools and all metal working plants an equipment of dies. The proportion that the value of these bears to the value of the whole varies greatly with the class of work. In many concerns fairly accurate records are kept of the cost of such small tools and dies. Experience has shown that factors per producing machine can be used that will give a fairly accurate appraisal. Where a closer estimate is needed, the tool and die store rooms can be examined and fairly representative shelves or drawers can be appraised to obtain a factor or factors to be used for the remainder.

Depreciation of Machinery

Machines vary greatly, both in the manner in which they wear out and in the rapidity with which they go out of date. In rare cases where a machine has been practically superseded in the market by one that will cost much less, it is better practice to use for a new value the cost of the less expensive machine rather than show an excessive depreciation. As a rule, the amount deducted applies chiefly to wear. With machines that need repairs at all points from time to time, a day arrives when it is better to scrap the machine and replace it. Practically all textile machines come in this class, as do engines and other power plant machines, and also some machine tools, wood working and paper working machines. To all of that nature a depreciation table is applied, allowing 2, 2½, 3, 4 or 5 per cent a year, deducted from the net and not from the gross. If a machine is entirely rebuilt, it is usually considered to be worth at that time within 5 per cent of new value and the table is applied for succeeding years. In either case, the probable average life is ascertained and the table that best fits is used, but seldom is the depreciation carried to a point beyond 50 per cent.

There are many kinds of machines where the main portion, sometimes as much as 80 per cent of the total value, remains for years with practically no wear. The small moving parts, however, wear so rapidly that they are constantly being replaced. This is true of a great variety of machine tools, metal, wood and paper working machines. With these it is considered that the wearing parts are always in a state of 50 per cent depreciation, and the amount deducted is half of the percentage the value of the wearing parts bears to the total value of the machine. This method also applies to rolling mills, rubber mills and calendars where the frames and gearing remain intact for years and the rolls constantly wear down and are replaced.

There is another class of equipment where neither the depreciation table nor the definite average described can be used. This class includes most of the machinery in paper mills, bleacheries and dye works where wet processes are used. These machines wear rapidly and are frequently rebuilt. Paper machines in particular are composed of a train of parts and from time to time different sections are either rebuilt or removed entirely and replaced. The depreciation in such cases depends upon the condition at the time of the appraisal and is not influenced by the age of what remains of the original machine. Main belts wear slowly, while machine belts will always average 50 per cent wear, so that, as a rule, the total amount of belting is depreciated 33 1/3 per cent. Small tools and dies wear out, but they are affected to a great extent by obsolescence. Patterns, drawings, molds and lasts are subjected to depreciation for the latter reason only. In determining the amount to be deducted from the new value of any of these the appraiser must ascertain what proportion of the equipment is indispensable or practically new.

Valuation of Industrial Methods

BY WALTER N. POLAKOV

THE question of determining the value of the physical properties of our industrial establishments and public utilities has been recently brought to public attention. The purpose was primarily to justify the increased cost of commodity rates and transportation as gravely influenced by heavy investments in the machinery of production. Discussing the subject at the conference on valuation held in Philadelphia in November, 1915, the writer said: "The loss to the companies from the undervaluation of their property is insignificant in comparison to the actual losses due to the lack of proper operating methods. The subject of correct methods of appraising a property is completely overshadowed by the importance of determining the proper method of using this property. * * * What is needed most is the correct valuation of operating and managerial methods in vogue, and overestimating the importance of property valuation is like trying to trace old sins instead of preventing the committing of new ones."

The solution offered by financiers and accountants of the old school was to include in the manufacturing cost all the fixed charges of a plant and all the financial obligations of a company, irrespective of whether these investments or expenses contributed anything to the value of the commodity or in any way benefitted the production. If the instruments of production were completely used up in the process this theory would be correct. However, in a typical case,

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the value of the instruments of production passes only partly into the cost of commodities as they are produced. Apparently the self-evident fact that the equipment not used in production cannot pass any part of its value into the product was usually obscured by a consideration that it loses value during idleness and meanwhile accumulates such charges as rent, interest and insurance.

Exclude Idleness Charges

The absurdity of including these expenses of idleness in the cost of an article, already bearing its share of fixed charges, was so clearly exposed at the Buffalo meeting of this society by H. L. Gantt, that any further argument seems superfluous. Present practice manifestly tends to charge against the cost of a product the cost of over-equipment and mismanagement, thus imposing on society the penalty for tolerating these conditions in the industries.

The paradox that adopting improved machinery devised by designers reduces the rate of profit of the enterprise, can be explained either by the fact that the improvement is merely illusory or that an improper use is made of the improvements.

Nevertheless, the tendency of the average rate of profit to fall is but an expression of progressive development of the productive powers of society. Automatization, growing speed and capacity of machinery cause the same number of laborers in the same time to convert a larger quantity of raw and auxiliary materials into product. In other words, the fall of the rate of profit is not due to an absolute, but only to a relative, increase of the capital invested in means of production over its part invested in labor. This law, though seldom recognized, is actually followed in our industrial development. It requires an increasing mass of total capital for the purpose of using the same quantity of labor to secure the same mass of profit, though at a falling rate of profit. If the mass of profit is to be increased through the introduction of improved machinery with corresponding increase of investment without curtailing the wages or lengthening the working day, the intensity of labor must be increased.

In other words, to keep pace with industrial progress in order to meet the requirements and competition, improved instruments of production must be adopted. Increase of investment is followed necessarily by reduction of the rate of profit, and in order to secure the same or larger earnings the manufacturer must expand the production—increase the investments. This is the process we actually observe in our industrial development. No amount of pains given to the subject of proper appraisal of physical property can alter the tendency for the rate of profit to fall. Salvation is sought therefore through raising the commercial profits by increasing the selling prices. This method, although temporarily expedient, overtaxes eventually the purchasing capacity of consumers and creates a so-called business depression.

A Delayed Crisis

At the outbreak of this war, our country was rushing headlong into a period of industrial depression caused by surplus production that could not be consumed in the United States on account of the small purchasing capacity of the people, and could not be exported because poor shop methods prevented us from producing as cheaply as other countries. The undeveloped stage of our credit system contributed a further obstacle to the development of export. There was no incentive for us to plunge into the war since there were no foreign markets to fight for, neither could anything be gained by a territorial expansion. A crisis seemed imminent, but the loading up of our industries with European orders postponed it.

The misuse of or failure to use the expensive machinery of production is not sufficient reason to either advance prices or to lower wages, as both undermine our future. Neither is it necessary. A manufacturer adopting superior methods of planning and managing his business, working with improved methods of production that have not yet become general, can sell below the market price, but above his individual cost of production. In this way his rate of profit rises until competition levels it down. During this period the second requisite comes into play—the expansion of the invested capital, facilitated by the previous period of accumulation. According to the degree of his expansion he will be enabled to employ all of his workmen or more.

Base Value on Methods

The appraisal of industrial property when accurately made discloses the fact otherwise overlooked that, as a rule, there are more means of production that are made use of, and the idle capital investments represent also idle labor. The revenue-producing factor in our mode of production is not the investment but the method of its use. It is the business of financiers to invest money in industries and they want to know what this investment is and what return they are getting.

This statement does not imply a suggestion to appraise property according to the capitalization of the earnings. The use-value of the plant has nothing to do with its cost-value and is in the highest degree unfit for the purpose, as it varies with personnel, policy and methods. Evolution in our industrial relations will eventually reverse the present situation and all charges for unprofitable investments and non-productive forces will not be borne by the consumers, who as yet have no power nor means to take an active part in the management of the industries. Unfit methods and incapable leaders are equally harmful to both investors and consumers, and their interests unite in demanding that methods of the highest value be developed.

Perpetual Inventory in Valuation Work

BY CHARLES PIEZ

MOST plants grow from small beginnings, and during their early life expand as the needs dictate. The organization is necessarily small because the most rigid economy must be practiced, and original costs and the costs of additions are frequently so completely submerged in the total assets that no safe records of these costs can be established. Many plants never outgrow this lump-sum treatment of assets. In these cases depreciation of plant and equipment is either wholly disregarded, or else an arbitrary amount is charged against profits, the amount of depreciation varying inversely as the size of the profit it is desired to show.

Industries so managed need the assistance of a competent appraisal company to inform them of the value of their assets, as a basis for embarking on a sounder and safer sys-

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tem of accounting methods. Practically all successful industries so maintain their inventories that additions to the plant are accurately recorded, and depreciation is based on judgment and experience. But even such industries will find it to their advantage to ask the aid of appraisal companies for the purpose of determining authoritative records of the cost of reproducing plant and equipment, so that underinsurance or overinsurance may be avoided, and the basis for the requirements of co-insurance complied with.

Appraisals are also valuable in establishing comparative values of plants no bearing on the value of the plant from the standpoint of the operating and sales management.

True Costs an Element of Success

The establishment of true costs is an essential element in the success of a business, and true costs can only be obtained when every item of expense is included. Buildings that were adequate when first erected gradually outgrow their initial advantages, and in spite of substantial increases shown in the appraisal value, they have less value for the purposes to which they are put than they had when first constructed. They may, in fact, prove so to replace it with modern equipment.

Patterns and small-tool equipment often have but temporary value and should disappear wholly from the inventory when they have served their purpose, yet these two items are fertile sources for inflation of values through appraisals.

What the management of an industry is chiefly concerned in is to provide a fund through a proper scale of depreciation which will reimburse it for the difference between the cost price of a piece of equipment and its fair cash selling price when sold either because it is ready for the scrap heap or because some newer form or

Depreciation Rates Adopted by Manufacturers Cost Conference, 1916

	Per cent on cost.	Per cent on reducing balance.
BUILDINGS AND ACCESSORIES:		
Reinforced concrete or steel and tile	2	3
Brick and steel with non-combustible roof and concrete floors	2.5	4
Brick, steel and wood	3	5
Brick and wood	3	5
Steel frame, wooden roof and corrugated iron walls	3.5	7
Steel frame, non-combustible roof and corrugated iron walls	3	6
Concrete block, with wooden roofs and floors	3.5	8
All wood structures, well built (20 years)	4.5	10
All wood structures, cheap (20 years)	5	12
Sprinkler system (20 years)	4	7.5
Heating and ventilating system (20 years)	4	7.5
Water and sewer piping and sanitary fixtures (where separate)	4	7.5
Tanks and reservoirs, steel	4.5	10
Tanks and reservoirs, wood (10 years)	9	20
MACHINERY AND LARGE EQUIPMENT:		
Boilers, pumps, feed-water heaters and air compressors	6	15
Power piping	6	15
Switchboards, main wiring and conduit	6	15
Engines and dynamos	5	10
Machinery, motors, machine tools, traveling cranes, etc.	4.5	10
Punch presses, bending rolls, power shears and drop hammers	4.5	10
Shafting, pulleys, hangers and belting	50	..
Machine tool accessories—Boring bars, drivers, key-seating broaches, etc. (All renewals to Repairs).	50	..
Cupolas, converters, melting furnaces and accessories	5	10
Annealing and heating furnaces, ovens, forges, etc.	5	10
Motor trucks	20	60
Storage-battery locomotives (battery renewals to Repairs)	10	30
Horses and wagons	12	35
SMALL TOOLS:		
For machines, net additions	50	..
Hand tools, net additions	50	..
PUNCHES AND DIES:		
(Standard) net additions	50	..
CHILLS, IRON AND STEEL FLASKS AND ACCESSORIES:		
Net additions	50	..
FIXTURES, FURNITURE AND MISCELLANEOUS EQUIPMENT:		
1 Steel shelving, lockers, etc.	5	12
2 Mechanical appliances, net additions	60	..
3 Departmental wiring and electric fixtures, net additions	60	..
4 Miscellaneous items (wood), net additions	70	..
PATTERNS (Standard):		
Metal, net additions	75	..
Wood, net additions	100	..
All patterns required for a particular order or contract to be charged to the job.		
DRAWINGS:		
All new standard drawings to be charged to expense.		
All drawings required for a particular order or contract to be charged to the job.		
MISCELLANEOUS REAL ESTATE IMPROVEMENTS:		
Pavements, sidewalks, fences, retaining walls, roadways, tracks, yard drainage, general conduits, tunnels, vaults, etc.	4.5	10

that are about to merge, or in serving as a basis of a scheme of financing. But the claims that an appraisal is necessary for figuring overhead costs and the selling price and profit of manufactured articles are, to say the least, sadly overdrawn.

It has been my experience that in well-managed industries appraisal values are usually considerably above sound inventory values established by the management. With the steady advance in prices that has been going on almost continually for the last 25 years, it is but reasonable to suppose that replacement values are substantially higher than initial costs, and it is well to establish the amount of such excess if a proper insurance coverage be desired; but such advance is wholly speculative and has absolutely unsuitable to the increasing needs of the business as to justify demolition and reconstruction.

Few owners foresee their needs for 10 years to come, and fewer still have the means to build or expand along lines giving ample opportunity for future business growth. It is safer, therefore, to provide proper sinking funds through an ample rate of depreciation for use in reconstructing buildings that have outlived their usefulness.

Where Appraisal Methods Fall Down

Machine tools have changed very considerably as a result of the development of high-speed steels, and companies that followed appraisal methods of depreciation find themselves with obsolete equipment and no funds method has made a change desirable. This difference is properly a part of the cost of the product, but becomes so only by charging depreciation against the expenses of operation.

Has any appraisal company ever investigated the subject of depreciation from the operating standpoint and recommended a schedule of depreciation for adoption? Has any appraisal company ever advocated that depreciation be distributed as an operating expense against the product? Can any appraisal company claim with any justice that it can determine proper rates of depreciation without close contact with and full knowledge of the operating conditions and operating needs of an industry? Certainly without such contact and without such knowledge the claim that successive

appraisals are essential factors in the determination of costs, prices and profits, is, to say the least, pure buncombe. The primary business of an appraisal company is to determine an authoritative replacement value, and its entire organization is trained for this purpose. But when the appraisers enter the field of depreciation, operating values, and costs, they are doing their clients positive harm; for appraisals, as previously explained, have a distinct upward tendency, and the increase in value which they show as the result of wholly extraneous conditions have the effect of lulling the manufacturer into a wrong sense of financial security.

The great majority of industries charge off too little for depreciation rather than too much, and the appraisal companies, if anything, are assisting, unconsciously, of course, in increasing this unprofitable and oft-times disastrous habit.

I had occasion recently to go over the financial statements of a manufacturing plan which had delegated the important function of depreciation to an appraisal company. The amount charged off annually was less than one-half of the proper amount, this being due, the owner said, to the constant and considerable advance in the replacement value of the property. Here was a typical case of reducing the operating burden of a plant by crediting it with a wholly speculative and unrealizable increase in property value. In this case the appraisal company specified the amount to be depreciated each year, and was therefore responsible for this wholly unsound and unscientific procedure. The owner is about to build a new plant, and I take no chances in prophesying that he has some bitter disappointments awaiting him in unforeseen shrinkages of assets when he abandons the old plant.

Largely as a result of the recommendations made by the federal trade commission that the cost-accounting systems of various lines of industry be standardized, the manufacturers of conveyors and elevators have agreed on the standard schedule of rates of depreciation given herewith. The rates are but compromises growing out of the judgment and experience of the individual members of the manufacturers' conference, but their correctness can later be verified by matching the perpetual-inventory values which these rates will establish, against the actual experience of loss in cash value when equipment or buildings are discarded.

They establish, therefore, a broad basis upon which fair operating values and the shrinkage in these values, due to wear and tear and change in style, can be computed, and serve as the preliminary step to the equitable distribution of these shrinkages or depreciation in value over the cost of the product.

I recognize the value of the work done by the appraisal companies in establishing authoritative replacement values for purposes of insurance, for the purpose of comparing the physical values of various plants about to be purchased or merged, or as the foundation upon which a perpetual inventory kept by the industry itself can be based; but I am convinced that only a perpetual inventory providing for a sound schedule of depreciation, and intelligently handled by the management of the industry, is of value in determining the true cost of the product.

Measuring Productive Capacity

BY H. L. GANTT

IF THERE is any one thing which has been made clear by the war it is that the most important asset which either a man or nation can have is the *ability to do things.* Our industrial and economical developments have in the past been largely based on the theory that the most important quality a man can possess is, his *ability to buy things;* but the war has distinctly shown that this quality is secondary to the *ability to do things.* The recognition of this fact is having a most far-reaching effect, for it makes clear that the real assets of a nation are properly equipped industries and men trained to operate them efficiently. The money which has been spent on an industrial property, whether it has been spent wisely or unwisely, and the amount of money needed to reproduce it are both secondary in importance to the *ability of that plant to accomplish the object for which it was constructed,* and hence cannot be given the first place in determining the value of the property.

Inasmuch as every industrial plant is built to produce some article of commerce at a cost which will enable it to compete with other producers, the value of a plant as a producing unit must depend upon its ability to accomplish the object for which it was created.

To determine the value of an industrial property, therefore, we must be able to know with accuracy the cost at which it can produce its product, and the amount it can produce. To compare two factories on this basis, their cost systems must be alike; for, if there is a lack of agreement as to methods of cost accounting, there will necessarily be a lack of agreement as to the estimated value of the properties. There are many methods of cost accounting; but there are only two leading theories as to what cost consists of. They are:

First, that the cost of an article must include all of the expense incurred in producing it, whether such expense actually contributed to the desired end or not.

Second, that the cost of an article should include only those expenses actually neded for its production, and any other expenses incurred by the producers for any reason whatever must be charged to some other account.

The first theory would charge the expense of maintaining in idleness that portion of a plant which was not in use to the cost of the product made in that portion of the plant which was in operation; while the second theory would demand that such expense be a deduction from profits. When plants are operated at their full capacity, both theories give the same cost. When, however, they are operated at less than their full capacity, the expense of carrying the idle machinery is, under the first theory, included in the cost of the product, making the cost greater; while under the second theory, this expense of idle machinery is carried in a separate account and deducted from the profits, leaving the cost constant. It is most interesting to note that, when costs are figured on the second basis, great activity immediately ensues to determine why machinery is idle, and to see what can be done to put it in operation. It is realized at once that this machinery had better be operated, even if no profits are obtained from its operation and only the expense, or even part of the expense, of maintaining that machinery is earned.

The accompanying illustration explains this subject clearly, and is an indication of the efficiency of the management as contrasted with that of the workmen, about which we hear so much. It is interesting to note that charts of this nature, which are being made monthly

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in several large plants, have already had a very educational influence on the managers of those plants. They show that idle machinery which cannot be used should be disposed of, and the money received, and the space occupied, put to some useful purpose.

A little consideration of the method of getting the data on this chart will make its value more apparent. It is based on the fact that simple ownership of a machine costs money, inasmuch as it takes away from available assets. For instance, if we buy a machine for $1,000 we lose the interest on that $1,000, say at 5 per cent per year, then we have taxes on the machine at 2 per cent and insurance of 1 per cent. Further, the machine probably depreciates at a rate of 20 per cent per year, and we must pay $50 or more per year for the rent of the space it occupies. All these expenses, together $330, go on whether we use the machine or not. Thus, the simple fact of our having bought this machine and kept it takes from our valuable assets approximately one dollar per day.

Ascertain the Cost of Idleness

If now the cause for idleness is ascertained each day we can find the expense of each cause of idleness as shown on the chart. That part which is due to lack of orders points out that our selling policy is wrong, or that the plant is larger than it should be—in other words that somebody is building the plant has overestimated the demand. It is clear, however, that no conclusion should be based on the figures for one month, but on the results for a series of months during which the problem has been carefully studied. If a mistake has been made in building tool large a plant, an effort should be made to determine the proper disposal, or utilization, of the excess, in order that the expense of idleness may be taken care of, even if not profit can be made.

The next column shows the expense due to a lack of help, which means that we must investigate the labor policy. The next column showing the expense due to lack of, or poor material, is an indication of the efficiency of the purchasing policy and storekeeping system. The next column reflects the repair and maintenance department. If in any case the expense of idleness is greater than can be attributed to all of these causes together, it must go in the last column as poor planning.

We can hardly claim that such a chart gives us a *measure* of the efficiency with which the above functions are performed, but it certainly does give us an *indication* of that efficiency. In several cases, the first of such charts resulted in the scrapping of machinery which had been idle for years. The space thus saved was used for a purpose for which the superintendent had felt he needed a new building. In another case it resulted in the renting of temporarily idle machinery at a rate which went far toward covering the expense of carrying that machinery.

Under the first system of cost accounting the facts brought out by this method are not available and the increased cost that a reduced output must bear is a great source of confusion to the salesman. The newer system with its constant cost shows that non-producing machinery is a handicap to the industry of a company, just as workmen who do not serve some useful purpose in a plant, or industry, are a handicap to that plant or industry. Similarly, plants or people, therefore, who do not serve same useful purpose to a community are a handicap to that community, for idle plants represent idle capital, and idle people are not producers, but consumers only. The waring nations have recognized these facts, and put both idle plants and idle people to work wherever possible.

The statements so far made concern principally the operation of industrial plants and the production of articles of commerce; but they are none the less true concerning the construction of industrial plants.

We may ask the same question about construction that we ask about operation; for instance, should the cost of a railroad include all the money spent by the people engaged in building it, or should it include only such money as contributed to the building of the road? As an illustration, is the cost of a piece of road which was built and then abandoned for a superior route a part of the cost of the railroad built, or is it an expense due to improper judgment on the part of the builders?

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SYMBOL	DEPARTMENT OR MACH. CLASS	% OF CAPACITY USED ON Day TURN (10 20 30 40 50 60 70 80 90)	TOTAL EXPENSE OF IDLENESS	DETAILS OF IDLENESS EXPENSE DUE TO: LACK OF WORK	LACK OF HELP	LACK OF AND POOR MATERIAL	REPAIRS	POOR PLANNING	REMARKS
	Spinning		18 70	18 70					
	Winding		118 74		103 74		15 00		
	Doubling		10 61	10 61					
	Twisting		17 95	17 95					
	Quilling		20 67	10 67	10 00				
	Warping		390 75			390 75			Lack of Wound Yarn
	Weaving		915 25	75 00		840 25			Lack of Warps
	Finishing		210 72			210 72			Lack of Woven Goods
	Inspecting		49 70		10 70	39 00			Lack of Woven Goods
	Shipping		216 17	66 00		150 17			Lack of Woven Goods
	Total		1969 26	198 93	124 44	1630 89	15 00		

APPROVED BY
SUPT.

IDLENESS EXPENSE CHART

Equitable Distribution

I am not discussing the question as to wether the public should be called upon to pay interest on the money uselessly spent through improper judgment, but I do thing that in all construction it should be possible to separate those expenses which contributed to the desired result from those which did not so contribute. A comparison of these amounts will give a measure of the efficiency of the builders. On this knowledge, proper action can ultimately be taken.

Still another factor enters into the value of a "going plant." We all have known cases where the same plant

operated under one manager was a failure, and under another a very decided success. The value of a going plant, therefore, consists of two elements; namely, the value of the physical real estate and equipment, and the value of the organization operating it. In considering the value of an organization we should realize that it lies not so much in the personality of the managers or leaders, who may die or go elsewhere, as in the permanent results of their *training and methods, which should go on with the business,* and are therefore an asset and are not an accident.

We have the authority of Andrew Carnegie for the statement that his organizations were of more value to him than his plants. Before we can determine exactly the value of a going plant, therefore, we must find some means of measuring the value of the organization which operates it, for this is an integral factor in the valuation of an industrial property, which is just as real as the more tangible brick and mortar of which building are composed. Our charts showing the expense of idleness give us at least a rough indication of this value, for they show the expense of inefficient and loose management.

If the above premises are correct, the following factors are important elements in determining the value of an industrial property:

The cost of the product

The capacity of the plant

The portion of the plant operated, and

The expense of maintenance of the idle portion.

Using Waste Heat for Generating Steam

BY ARTHUR D. PRATT

THE utilization of waste heat from various industrial processes for the generation of steam is not new. The advance within the last few years, however, in methods of utilizing such gases and in the results secured from their utilization has been so remarkable as to make of interest a comparison of former with present-day methods and results.

The design of waste-heat boilers has progressed to a point where it is today possible to generate steam successfully from gases whose temperatures are as low as 950 or 1000 degrees Fahr. It is but a few years since it was considered absolutely impracticable from a commercial standpoint to attempt to produce power from such gases, and it is in its ability to satisfactorily utilize these gases that the development of the modern waste-heat boiler has its most far-reaching effect.

The sole theory on which early waste-heat boiler installations were made had as its basis the non-interference in the operation of the primary furnace. This meant, in practically all cases, that the draft at the exit of the primary furnace should in no way be impeded, and resulted in the installation of a given amount of heating surface arranged in such manner that the frictional resistance to the gases in their passage through the boiler should be a minimum. Presumably the object of such an arrangement was to enable a natural-draft stack of a practicable height to be used. As the result of minimizing this draft loss, such boilers as were installed were ordinarily entirely without baffles and the gases were given a straight passage through the boiler, though partially baffled boilers were used occasionally. High exit gas temperatures were considered rather desirable than otherwise in order to assist the stack in giving the required drafts.

Boilers installed in this way were considered practicable only with gases whose temperatures approached those of coal-fired practice. The users accepted the steam generated as "something for nothing," and no particular endeavor was apparently made toward increased capacities.

Present day waste-heat practice has come about with a more thorough understanding of the laws governing heat transfer and an appreciation of the function of gas velocity as affecting transfer rates. Without going into this aspect, it may be broadly stated that the rate of heat transfer is dependent upon gas velocity and temperature difference between the gas and the absorbing surface. Experiments have shown that at even the highest velocities now used in waste-heat work the effect of increased temperature difference is small as compared with that of increased gas velocity.

In coal-fired boiler practice the average temperature difference between gases and boiler surfaces is approximately 1150 degrees Fahr. The heat-transfer rate corresponding to a boiler's rated capacity is about 3 B. T. U. per hour per square foot of surface per degree difference, or a heat absorption of 3450 B. T. U. per square foot

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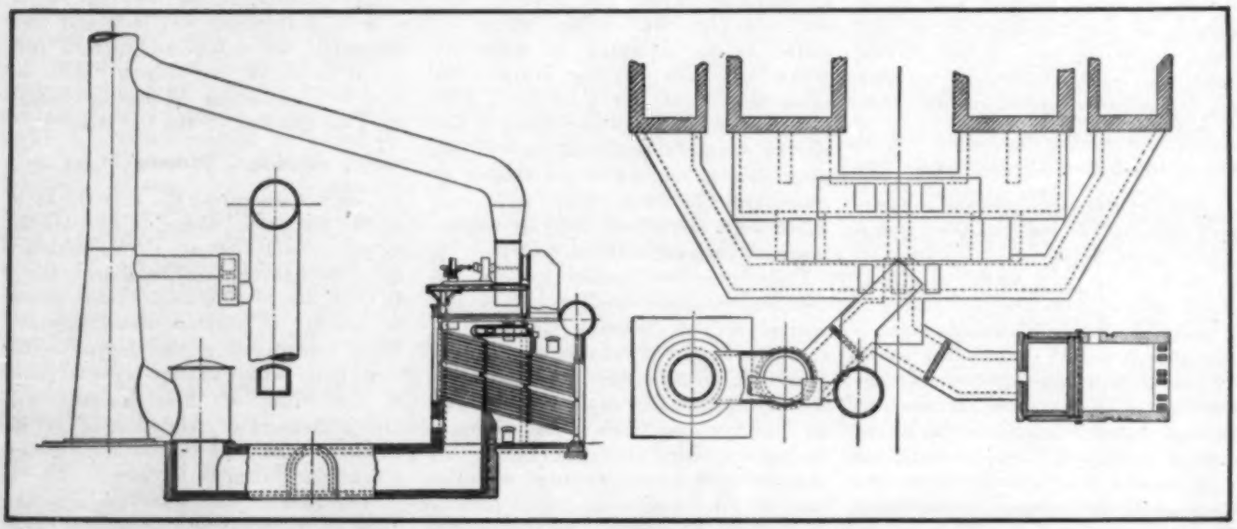


FIG. 1—WASTE-HEAT BOILER FOR OPEN-HEARTH FURNACE

of surface per hour. In waste-heat work the temperature difference varies widely with the class of waste-heat. With a gas temperature, say, of 1250 degrees Fahr. entering a boiler, the average temperature difference between boiler surface and gas for a working pressure of 170 pounds per square inch will be about 500 degrees Fahr. For such a temperature difference the transfer rate, to give an absorption per square foot of surface equal to that of the coal-fired boiler at rating, would have to be 6.9 B. T. U. per hour per square foot per degree difference. This rate is slightly higher than the rates corresponding to velocities that are as yet ordinarily used, but with somewhat higher entering gas temperatures the absorption per square foot of surface is such as to enable a boiler's rated capacity to be developed without difficulty. With gas temperatures entering the boiler of 1800 to 2000 degrees Fahr., which approach coal-fired practice, high overloads are being developed.

The gas velocity necessary to give what is now considered a desirable transfer rate lead to a frictional resistance through waste-heat boilers which makes the use of a natural-draft stack impracticable. Let us consider what is probably the extreme case in so far as draft conditions are concerned, namely, the open-hearth steel furnace. Common practice in this class of work is to use stacks 160 feet high, which give a draft at their base approximately 1.4 to 1.6 inches, depending upon the gas temperatures. For the present purpose, assume that the draft loss through a modern waste-heat boiler installed with an open-hearth furnace is 2.0 inches, a figure which approximately represents the practice of today. With a natural-draft stack, the draft at the checkers corresponding to the 1.4 to 1.6 inches given above is approximately 1.3 to 1.5 inches, and this amount is necessary for the proper operation of the furnace. With a waste-heat boiler installed, then, the draft necessary at the exit of the boiler must be sufficient to overcome the resistance through the boiler, 2 inches, that necessary to overcome resistance through the flues, say 0.75 inch, and 1.5 inch necessary at the checkers, or a total of 4.25 inches. It is to be remembered that with a waste-heat boiler installed, the temperature of the gases entering the stack, instead of being 1000 to 1200 degrees Fahr., will be 450 or 500 degrees Fahr., under which conditions a stack of 160 feet instead of giving a draft of 1.4 to 1.6 inch at its base would give approximately 0.9 inch, and to give the necessary 4.25 inches the stack height would have to be somewhat over 700 feet.

While, as stated, this is perhaps the extreme case, the same reasoning applies in practically all waste-heat work, and an induced-draft unit is now almost universally used with the modern design of waste-heat boiler. In certain classes of waste-heat work, such a fan not only furnishes the required draft suction, but is of a decided advantage in the operation of the primary furnace. This feature will be discussed in connection with the individual classes of waste heat later considered.

Waste-heat boilers of the modern design are in successful operation today with copper-refining furnaces, cement kilns, open-hearth steel furnaces, beehive coke ovens, zinc-refining furnaces and heating furnaces of various types, both regenerative and non-regenerative. As stated, the waste-heat boiler of today was developed with low-temperature gases and its largest field, until the present, has been with open-hearth steel furnaces.

This particular phase of waste-heat work may be considered new. In the

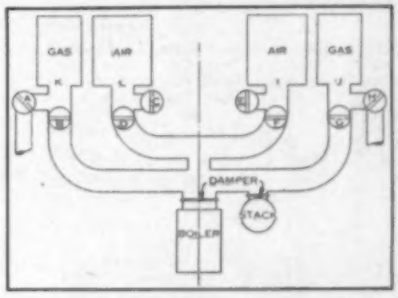


FIG. 2 — LAYOUT OF CHECKERS, VALVES, FLUES, STACK AND BOILER INLET

open-hearth steel furnace we have the best and by far the most numerous examples of the regenerative furnace. From the very nature of the operation of such furnaces, gas temperatures passing to the stack are low, and the ability of the modern waste-heat boiler to utilize successfully these gases for the generation of steam is, without question, the best proof of the progress in the development of this particular class of boiler.

An experimental waste-heat boiler for this work, embodying the principles but possibly not the design of the modern waste-heat boiler, was installed at the South Chicago plant of the Illinois Steel Co., in 1910. The results from this installation, while by no means comparable with those secured today with the more highly developed design, so clearly indicated possible savings in the practically untried field of open-hearth practice that two boilers, the design of which may be considered well past the experimental stage, were purchased for this same plant in 1911.

The first of these, at the plant of the Illinois Steel Co., in South Chicago, consisted of two Stirling boilers equipped with special cross baffles to give the desired gas velocities over the heating surfaces.

The second installation, made at the Gary plant of the Indiana Steel Co., consisted of 28 special 6-drum Rust boilers equipped as in the case of the Stirling boilers with special cross baffles.

The third installation described is that made at the Pencoyd works of the American Bridge Co. and consists of a cross-drum Babcock and Wilcox boiler, the width of boiler and the tube length being such as to give the gas-passage areas necessary for the required gas velocity. For low-temperature waste-heat work, the type of boiler of which this installation is an example is in general best suited. Fig. 1 shows a typical layout of a boiler of this last design.

Table I gives the results secured from the Stirling and Rust boilers described and from Babcock & Wilcox boilers similar in design to that installed at Pencoyd, though set with considerably larger open-hearth furnaces. Test 4 is included as being of interest in indicating the results that may be secured with gases at a temperature considerably below that ordinarily found in open-hearth work. At this particular plant, the gas temperatures leaving the checkers were not appreciably lower than in other tilting furnaces, but the necessary flue arrangement was such that there was an excessive radiation loss between the checkers and the boiler from flues and reversing valves.

In Table I the proper basis for the comparison of results is the rate of heat transfer, but in order that such a comparison may be intelligent, it is necessary in connection with the transfer rates to give proper consideration to the gas weights per square foot of heating surface, entering and exit gas temperatures, and the percentage of rated capacity developed. To give a direct comparison of the performance of two different boilers, the gas weight per square foot of heating surface and the entering gas temperature should be approximately the same.

It is possible from our present knowledge of the laws of heat transfer to compute with surprising accuracy the results that may be expected from any boiler for a given set of conditions. Let us consider, then, the results which the boiler of Test No. 4 would give under the gas conditions of Test No. 1. For a weight of gas per square foot of surface corresponding to Test No. 1, the total weight of Test No. 4 would become 98,950 pounds per hour.

With this weight passing through the boiler of Test No. 4, at the temperature actually existing in No. 4, the boiler

would develop approximately 363 horsepower, or 67 per cent of its rated capacity. With an entering temperature equal to that in Test No. 1, the boiler would develop approximately 500 horsepower, or 92 per cent of its rated capacity. These figures are included simply to show the importance of giving all factors proper consideration where a comparison of results is to be made.

Location of Boilers

The early boiler installations were made with open hearth furnaces already in operation. With these furnaces it was necessary to connect the boiler to the flue between the reversing valves and the stack, the boiler thus being on a branch flue while the stack was on the more direct connection. It was and is common practice, in laying out open-hearth furnaces, to place the stack central with the furnace, and wherever such an arrangement is followed the boiler would of necessity be on the branch flue.

It is recommended, and today this recommendation is being more or less followed, that the boiler be placed central with the furnace and the by-pass stack on the branch connection. Such an arrangement will give a straight gas passage to the boiler, minimizing frictional resistance in the connecting flues due to the absence of turns, and will have a tendency to give an equal distribution of the gases across the width of the boiler.

The flues from the reversing valves to the boiler should be as short as possible to minimize radiation losses. The location of such flues, with the same object in view, is also of importance. Ordinarily these are placed underground, and their depth beneath the surface should be such as to furnish a sufficiently thick insulating layer of earth on top. The best practice is to make this layer from 3 to 4 feet thick. In one installation where, because of certain unavoidable conditions, the thickness of the earth covering on the top of the flue was something less than 1 foot, the temperature of the surface of this earth was over 400 degrees Fahr. The loss from radiation from such a flue is obvious.

Ample means should be supplied for keeping these connecting flues clean, and the area should be such as to allow a certain amount of accumulation of dust when the furnace is down without impending the draft. The average life of an open hearth furnace is probably around 300 heats, though occasionally 350 are obtained. When the amount of dust carried in the gases is considered, it is readily conceivable how there can be an accumulation between furnace lay-off periods that will seriously affect the draft. In one instance where, because of press of work, the connecting flue was not cleaned out during two periods when the furnace was down, the dust had filled the flue to more than a third of its closs-sectional area.

Table I

Results of Tests of Waste-Heat Boilers for Open Hearth Furnaces

Test Number	1[1]	2	3	4
Plant	Illinois Steel Co.	Indiana Steel Co.	Bethlehem Steel Co.	Lackawanna Steel Co.
Location	So. Chicago, Ill.	Gary, Ind.	So. Bethlehem, Pa.	Buffalo, N. Y.
Rated capacity of furnace, tons	65	75	80	[5]
Actual production, tons	72[2]	85	82.6	.....
Boiler	Stirling	Rust	B. & W.	B. & W.
Heating surface, sq. ft.	4,000	4,880	5,232	5,407
Superheat, deg. Fahr.	128	176	121	97
Gas weight, lb. per hr.	73,000	83,434	75,271	78,947
Gas per hr. per sq. ft. of h. s., lb.	18.3	17.1	14.4	14.6
Temperatures:				
Gas entering boiler, deg. Fahr.	1,227	1,155	1,362	986
Gas leaving boiler, deg. Fehr.	621	530	493	468
Drop in temp., deg. Fahr.	606	625	869	518
Draft at boiler inlet, in.	.....	1.47	1.55	1.76
Draft at boiler damper, in.	.....	3.95	3.29	3.63
Draft loss, in.	1.78	2.48	1.74	1.87
Gross h. p. developed	334.5	393	425.8	306
Per cent of rated capacity[6]	83.6	80.6	81.4	56.7
Boiler h. p. to fan	[3]	60[4]	24.3[3]	.....
Net horsepower	.....	386	401.5	.....
Approximate transfer rate (R)	5.08	6.92	4.77	5.12

[1]Average of ten tests.
[2]Approximate.
[3]Motor-driven fan.
[4]53 h. p. returned in feed-water heater.
[5]Tilting furnace.
[6]All ratings are on the basis of 10 sq. ft. per h. p.

Air Leakage

Too much importance cannot be attached to keeping flue connections and boiler settings tight in order to minimize air leakage, the effect of which is to reduce gas temperatures, decrease boiler capacity, and place an added burden on the fan unit.

The effects of air leakage and the possible improvement in results through its reduction may be shown by an example: One of the early boilers installed was with a small furnace which had been in operation for some time. The boiler was first put into service with no particular attention given to the tightness of existing flues, and a continuous run of 119 hours was started. For the first day or two, the gas temperatures entering the boiler were very low, the temperature drop between the checkers and the boiler entrance being some 650 degrees Fahr. This excessive cooling of the gases was found to be due to air infiltration through the length of the flue and an excessive amount of leakage at the stack by-pass valve. Nothing could be done toward remedying the latter defect, while the furnace was in operation, but flue leaks were stopped as far as possible without stopping the test. The reduction in these leaks increased the gas temperatures entering the boiler at the end of the run to approximately 1000 degrees Fahr., as against 600 to 650 degrees Fahr., at the start. The average gas temperature entering the boiler during this run was 855 degrees Fahr.

Minimizing Air Leakage

The furnace was then shut down, the sources of air leakage more thoroughly gone over, and the leaky dampers repaired and sealed. A second run of 120 hours was then started, during which the average gas temperature entering the boiler, with the furnace conditions as nearly as possible like those in the first run, was 1153 degrees Fahr. The loss between checkers and boiler was reduced to approximately 300 degrees Fahr., most of which was due to a faulty reversing valve that could not be repaired without replacing.

The results of the two runs, showing the effect of reducing leakage, are as follows:

	Run No. 1.	Run No. 2.
Gas entering boiler:		
CO_2	8.08	10.49
C	11.46	8.29
Gas temp. entering boiler	855	1153
Gas temp. leaving boiler	426	479
Draft boiler damper	3.99	3.77
Draft boiler inlet	1.85	1.85
Draft drop	2.14	1.92
Steam to fan engine (in terms of boiler horsepower)	35.70	28.10
Horsepower developed	132.40	200.20
Per cent of rated capacity	53.80	81.40

It is of interest to note from these figures that by minimizing the air leakage the draft loss through the boiler was reduced 0.22 inch, which made possible a lower fan speed with a considerably higher economical rate for the fan turbine. A saving was effected of 7.5 boiler horsepower for the fan drive, and there was an increase of 67 gross

horsepower. Although this may be an extreme case, the enormous gains secured by reducing the air leakage to a minimum are obvious.

Air leakage through the flues can be minimized through proper design and location. Leakage through the boiler setting is reduced by the use of a compact design, well-erected and bricked in, with precautions to prevent leakage about all cleaning and dusting door frames. Much can be done by painting the settings with asphaltum paint.

As has been stated, the waste gases from open-hearth furnaces are very dirty; and because of the low temperatures, it is, perhaps, of more importance in this class of work than in coal-fired practice that the heating surfaces be kept clean. In the early installations, fears were expressed that dirt would have a tendency to stick to the tubes and be difficult, if not impossible, to remove. Experience has shown, however, that ordinary methods of dusting give perfectly satisfactory results.

In practically all plants now operating waste-heat boilers in connection with open-hearth furnaces, the boilers are dusted once in 24 hours. In one plant which operates 11 such boilers and in which the results are checked perhaps more closely than in the average steel plant, the engineers have concluded as the result of actual experience that it pays to dust every 8-hour shift.

Frequent Cleaning Pays

Some figures showing the effect of dusting on exit-gas temperatures are of interest. In a certain plant a series of tests were run with cleaning intervals of 20, 10 and six hours. When the boiler was allowed to go 20 hours without cleaning, the reduction in gas temperatures after cleaning was 60 degrees Fahr.; where the cleaning intervals were 10 hours, 50 degrees, and where 6-hour intervals elapsed, the reduction varied from 10 to 30 degrees Fahr. In a second plant, with larger boilers, after an undusted period of 24 hours, for an unchanged entering temperature the exit temperature was reduced 35 degrees by a thorough cleaning. In this instance, with the gas weight passing through the boiler, this 35-degree reduction was equivalent to an increase of 22 horsepower. This increase in capacity would not, of course, hold over a period of 24 hours, but it would appear conservative to state that the 24-hour cleanings for such conditions would correspond to at least a net saving of 10 horsepower as against 48-hour cleanings. At $40.00 a year per horsepower—a rough estimate of the yearly value—this would mean an annual saving of $400.00 per boiler.

Customary practice has been to use a vertical cast-iron sliding damper for the stack by-pass. Considerable difficulty has been experienced in keeping such dampers tight, and where the stack connection, rather than that to the boiler, is the direct connection, difficulty through warping has sometimes occurred. While as far as is known it has never been tried, it would appear that a damper similar in design to reversing valves warranted a trial, in order to reduce leakage at this point. Such a damper would automatically close the passage to the stack when that to the boiler was open, and vice versa, at the same time stopping all air leakage at a point where this might be excessive. It is possible that such a design of by-pass damper would require a small amount of cooling water, but the loss in heat to this water, would, it is believed, be more offset by the gain through reduced air leakage.

Explosions

In the operation of open-hearth furnaces certain characteristic explosions are liable to occur during the reversal of gas valves. These vary in intensity from slight puffs to rather heavy explosions, and are caused by a mixture of fresh air with carbon monoxide which must pass off during the operation of reversal. Such explosions, often unnoticed with furnaces directly connected to a stack, become very evident where boilers are installed, and every effort is made to keep flues and settings tight. It was feared, and rightly, that with the installation of waste-heat boilers the heavier explosions might have a destructive effect on the boiler settings and connecting flues. For this reason particular attention should be given to proper buckstay construction, and an ample number of explosion doors should be furnished to relieve the pressure within the setting, should explosions take place.

Overcoming Explosion Difficulty

A thorough investigation of the trouble from explosions showed that by a proper system of reversing-valve operation the difficulty would be practically overcome; certainly to an extent where sufficient and properly designed explosion doors would obviate the possibility of wrecking or injuring the settings.

A method of reversal that experience has shown gives satisfactory results is as follows: Fig. 2 shows in diagrammatic form a typical layout of checkers, valves, flues, stack and boiler inlet, the valves being indicated by *A* to *H*, inclusive, and the checkers *I* to *L*, inclusive.

Assuming the gases from the open hearth are passing through the gas checkers *J* and the air checkers *I*, the order of operation is:

1 Turn off steam to producers
2 Close air stack valve *F*
3 Close gas inlet valve *A*
4 Close air inlet valve *C*
5 Open gas stack valve *B* (producer gas held in gas checker *K* now passed to boiler)
6 Close stack valve *G*
7 Open air inlet valve *E* (air now admitted to the furnace to give proper

Table II

Results of Tests of Waste-Heat Boilers With Steel Furnaces

Test Number	1	2	3[3]	4[3]	5[3]
Plant	Penn. Bolt & Nut Co.	Cambria Steel Co.	Bethlehem Steel Co.		
Location	Lebanon, Pa.	Johnstown, Pa.	So. Bethlehem, Pa.		
Furnace	Puddling	Heating	Structural Mill Reheat'g Furnace		
Boiler	3 Pass B. & W.	Sgl. Pass B. & W.	B. & W.	B. & W.	B. & W.
Heating surface, sq. ft.	1,196	2,998	5,840	5,840	5,840
Gas weight, lb. per hr.	.....	16,150	87,571	63,932	80,757
Gas per hr. per sq. ft. of h. s., lb.	.....	5.4	15	11	13.8
Temperatures:					
Gas entering boiler, deg. Fahr.	.....	1,990[1]	1,745	1,071	1,445
Gas leaving boiler, deg. Fahr.	542	729[2]	436	401	418
Drop in temp., deg. Fahr.	.....	1,261	1,309	670	1,027
Draft at boiler damper, in.	0.32	0.23	1.87	1.15	1.50
Draft at boiler inlet, in.	.....	0.19	0.68	0.39	0.54
Draft loss, in.	.....	0.04	1.19	0.76	0.96
Horsepower developed	73.2	152.8	784.1	326	542
Per cent rated capacity	61	50.9	134	56	93
Approximate transfer rate (R)	.....	1.7	6.1	5.0	5.4

[1]Optical pyrometer.
[2]Varied at different periods of furnace operation from 604 deg. to 920 deg.
[3]Tests 3, 4 and 5 on same boiler. No. 3 represents 12-hr. period during which the structural mill was in operation, No. 4 a 12-hr. period with the mill not operating, and No. 5 a continuous run of 104 hr. during which the mill operated 56 hr. and was not in service 48 hr.

combustion upon the opening of the gas valve)

8 Open gas inlet valve *H*
9 Open air stack valve *D*
10 Turn on steam to producers.

The essential feature in such a sequence of operation is, of course, to avoid opening the stack valves from gas and air checkers simultaneously, or nearly enough together to allow the hot producer gas and air from the checkers to mingle and ignite within the flues or boiler settings. In this system of reversal the air stack valve *D* is opened a sufficient interval after the opening of the gas stack valve *B* to allow the gas pocketed in the checkers *K* to pass away and mingle with the existing gases before the hot air from the checkers *L* is admitted to the flues through opening the valve *D*. In reversing the operation, similar precautions should be taken respecting gas stack valve *G* and air stack valve *F*.

In a plant where this system was followed, explosions were reduced from approximately 40 per day (about one each two reversals), varying in intensity, to 4 in 411 consecutive reversals covering a period of five days, and of these four but two could be called heavy and were directly traceable to a leak in a hydraulic valve which, through the operation of the ram, caused the gas valve to unseat.

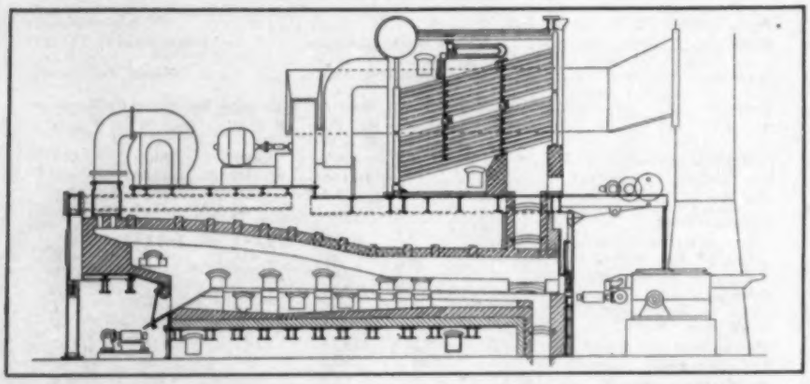


FIG. 3—REHEATING FURNACE AND WASTE-HEAT BOILER ARRANGEMENT

Savings

Great savings have been made possible by the installation of waste-heat boilers with open-hearth furnaces, and some approximate figures are of interest.

There have been installed, or ordered, over 90,000 rated boiler horsepower for this class of waste-heat work alone. These boilers are set with over 190 open-hearth furnaces, the annual total production of which is considerably in excess of 9,200,000 tons of steel. Experience has shown that through the use of waste-heat boilers the net cost of production of this material is reduced from $0.20 to $0.25 per ton, which would mean a net annual saving for the production weight given above of $1,840,000, using the lower figure.

From another aspect: A conservative estimate of the power delivered by the boilers in this class of work through a year's operation would be 60 per cent of their rated capacity, or 54,000 horsepower. The value of a boiler horsepower in a steel mill varies widely with any number of factors, and ranges from $35 to $50 per year. On the basis of the lower figure, which is certainly conservative, the value of the 54,000 horsepower produced would represent a saving of $1,890,000.

Waste-heat boilers, because of their special design, are more expensive than coal-fired boilers, and the expense is increased by the cost of fans, connecting flues, and structural material. The latter expense, of course, is the greatest where boilers are installed with existing furnaces. Regardless of this increased cost, however, the return on the investment is such as beyond question to warrant the expenditures. Mr. Bacon, in the paper to which reference has been made, states that this return on the investment is 60 per cent or over, and recent experience would seem to indicate that this figure is conservative.

In the early days of this work, open-hearth steel furnace operators were fearful that the installation of waste-heat boilers with their fan units would seriously affect the operation of the furnace, and that the production would be cut down, the cause of such reduction being in the necessity of longer heats. By actual experience just the contrary was found to be true, and furnaces equipped with boilers showed a decrease in time of heats.

In one instance, a 35-ton furnace equipped with a waste-heat boiler and fan was set in a line with five other furnaces not so equipped. The operation of all furnaces was alike and the size of the heats the same. Over a period of six days the average time of heat for the furnace equipped with the waste-heat boiler was 9.17 hours, while the average for the other five furnaces was 11.17 hours.

There is a further saving due to the use of the induced-draft fan with which these waste-heat boilers are equipped. This is in the increased life of the furnace and results from the fact that a fan makes it possible to run economically a heat from a furnace which under ordinary natural-draft conditions would take so long that it would not pay.

Heating Furnaces

The first boilers for any class of waste-heat work were unquestionably installed with heating furnaces of different descriptions, and the early history of boilers with heating furnaces is in reality the early history of the utilization of waste heat in general. While the writer does not know the actual date of the first installation, it is certain it was previous to 1872. Before that date such boilers as were used in connection with heating or puddling furnaces were of the cylinder or two-flue design.

An article in *The Iron Age* of April 6, 1893, describes the early installations of water-tube boilers for this class of work and gives some more or less complete results of the performance of a number of these boilers. The first of these installations was made at the plant of the McCullough Iron Works, Wilmington, Del., in 1874, and consisted of two boilers of the Babcock and Wilcox design made up of seven sections of six 16-foot tubes. Each boiler contained 860 square feet of heating surface and in accordance with the practice of the day were rated on the basis of 11½ square feet per horsepower, or 75 horsepower. To quote the journal mentioned: "These boilers, erected 17 years ago, have been in constant use ever since and have given entire satisfaction."

A number of boilers similar to these were installed after 1874 in the different iron and steel plants throughout the country. Test 1, Table II, is representative of the performance of this design of boiler. This test was conducted by J. de Kinder at the plant of the Pennsylvania Bolt & Nut Co., Lebanon, Pa. At this same plant a test on a cylinder boiler in the same service showed exit temperatures considerably in excess of 1000 degrees Fahr. as compared with 542 degrees Fahr. for the water-tube boiler, and this temperature difference probably represents the difference in efficiency of the two types of boiler on this class of work.

In 1892 a type of single-pass waste-heat boiler was introduced by The Babcock & Wilcox Co. It is not quite clear why such a design was developed, but the presumption is that with increased furnace capacities the draft loss through a sufficient amount of heating surface

in a three-pass design was great enough to interfere with the operation of the furnace. These boilers were of standard sectional Babcock & Wilcox design, but with tubes of 8, 9 and 10 feet in length. The heating surface required to cool the gases sufficiently was obtained in the height of the boilers, and these were made from 18 to 27 tubes high.

The results as compared with the earlier three-pass boilers are considerably in favor of that type. Some 7,500 horsepower of the single-pass design were installed, and in general the results secured were considered commercially satisfactory. Occasional installations of this design of boiler are still made. Because of the construction the boiler was expensive, and probably for this reason was never as popular as the next design of single-pass waste-heat boiler.

This was the Cahall waste-heat boiler, introduced in 1894 by the Aultman & Taylor Machinery Co. This was a single-pass vertical boiler in which the gases were introduced through an annular ring in the mud drum. Baffles were placed in the cone between the tubes with the object of throwing the gases into the tubes, but in view of the temperatures frequently encountered, it is questionable how long such baffles remained in place.

In 1914 the first waste-heat boilers of strictly modern design and utilizing the theory of high gas velocity were installed for this class of work by the Bethlehem Steel Co. These boilers were of the general design described in connection with open-hearth-steel practice, and were made up of 19 sections of 17 tubes 16 feet long. They were rated at 584 horsepower each, were equipped with superheaters designed to give approximately 75 degrees Fahr. of superheat, and furnished with motor-driven induced-draft fans. They were set in connection with two 28-inch structural-mill reheating furnaces, the approximate arrangement of furnace, boiler and fan being shown in Fig. 3. An extensive series of tests was run on one of these boilers in the early part of 1915. During these tests the structural mill was operated during certain shifts of 12 hours, while during other shifts the mill was not in service, though the furnace was kept hot. Under these conditions, since the temperatures were considerably lower while the mill was in operation, tests covering a wide range of gas temperatures are available, and the boiler performance under such conditions may be noted. Table II gives three of the tests on this boiler. Test 3 of this table represents a 12-hour period during which the mill was in operation, Test 4 a 12-hour period during which the mill was out of service, and Test 5 a continuous run of 104 hours, during which the mill was being operated for 56 hours and was out of service for 48 hours.

The draft loss through the modern boiler, as indicated in the last three tests of Table II, is reasonably high, though not nearly as great as found in open-hearth and cement-plant waste-heat practice. Since the fan on this boiler was motor-driven, none of the power required for such drive could be reclaimed in the boiler feed. The amount of power required however was small, the maximum for the whole series of tests being about 2 per cent, while the average was 1.55 per cent of the total power generated by the boiler.

In this class of work the only saving through the use of waste-heat boilers is the value of the steam generated. This, however, is certainly a considerable item, and it would appear that there are numerous industrial furnaces that are similar to heating and puddling furnaces and where the temperatures are comparable, with which the installation of waste-heat boilers can show a handsome profit on any investment made.

While by far the greater number of waste-heat boilers in service are in the industries outlined above, there are numerous installations in plants of different character. Waste-heat from zinc furnaces, nickel-refining furnaces, gas benches and oil stills has been utilized to some extent in boilers similar to those described, and is effecting satisfactory economies.

Sparks from the Grinding Wheel

By H. O. Tair

JAPANESE agents have been going through many thousands of Chinese temples and shrines divesting them of the bronze and brass Buddhas, shipping them to Japan for conversion into war materials. The yellow men haven't the brass, but they apparently have the brass to get the brass.

* * *

In a recent issue of Graphite, the house organ published by the Joseph Dixon Crucible Co., we find a good reason for this column.

"The wisest men that e'er you ken
Have never deemed it treason
To rest a bit—and jest a bit,
And balance up their reason;
To laugh a bit—and chaff a bit,
And joke a bit, in season."

—M. G. Kains.

* * *

Nov. 1, 1916, saw the end of 27 months' warfare with 1,820 merchant ships, tonnage aggregating 3,328,584 sunk by belligerents. Why not call this the "umbrella" fleet—it's under water?

* * *

The Sturtevant Aeroplane Co., Jamaica Plain, Mass. (we learn from our esteemed contemporary, *The Iron Trade Review*), is filling an order from the United States government for 24 machines costing $219,600. This must have come as a result of the Jamaica "pep" possessed by Grover C. Leonard, general manager of the concern.

* * *

Check-Mated

Where will they move next in the belligerent chess game? Germany's submarines go under the Allies' blockade, and now a report has it that work has been commenced on the tunnel from Great Britain to France under the English channel which will permit a "dive" beneath the submarines.

* * *

The Quakers Always Were a "Sweet" Sort of Folk

Three vessels containing 8,640,000 pounds of sugar were unloaded at Philadelphia wharves the early part of November.

* * *

From an exchange comes the information that vast deposits of a superior grade of iron ore, extending 4 miles under the ocean, have been found at Belle Isle, Newfoundland. H. O. Tair hereby notifies any divers who may be interested that he has opened up a school and guarantees to teach submarine mining in 42 lessons.

* * *

It is announced that F. Blumenthal & Co., Wilmington, Del., have closed a contract with the Russian government for $1,500,000 worth of leather. Is this for straps for the bad boys on the other side or is it for strops? The Russians might contemplate following the French lead in getting rid of their whiskers.

* * *

New Stiles in the National Radiator

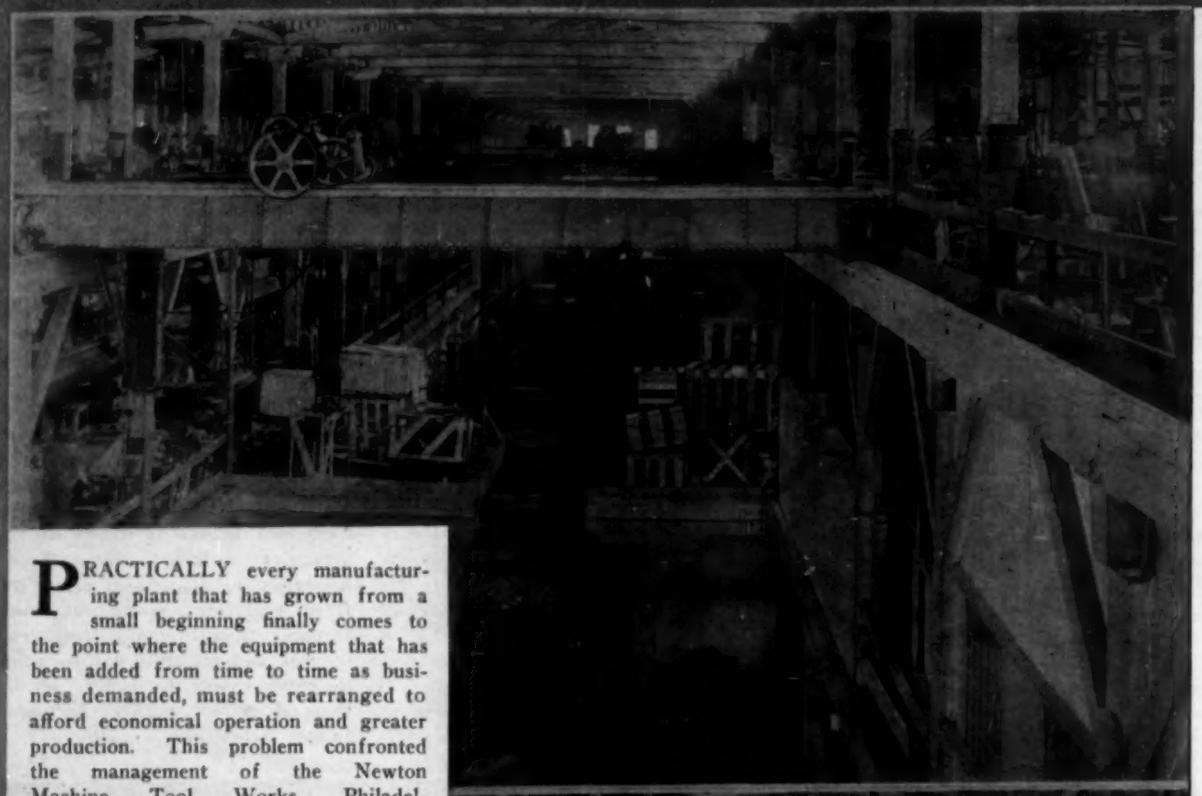
We learn from an exchange that Wm. S. Stiles becomes the general manager of the Trenton, N. J., plant of the National Radiator Co., taking the place of Charles V. Bower, who resigned last month.

* * *

Score: Love-40, Whitehouse vs. Wilhelmstrasse

We presume this latest submarine merchant marine activity will occasion the resumption of the tennis game of notes on the Atlantic "court".

Newton Machine Tool Works



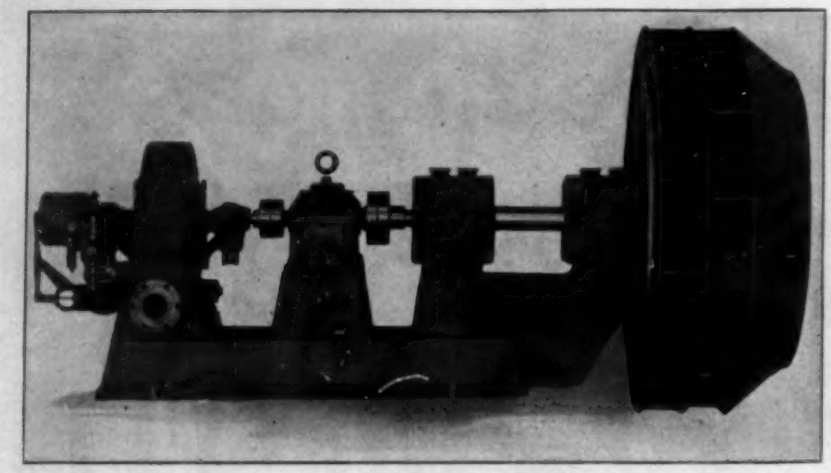
PRACTICALLY every manufacturing plant that has grown from a small beginning finally comes to the point where the equipment that has been added from time to time as business demanded, must be rearranged to afford economical operation and greater production. This problem confronted the management of the Newton Machine Tool Works, Philadelphia, several years ago, and was the outcome of a gradually increasing need of facilities for building larger and heavier machines. It was evident that a regular grouping of like machines to permit direct routing of work through the shop was necessary. A plan was formulated to relocate all tools in order that successive machining operations

Makes Extensive Changes

might be expedited, and to permit the grouping of machines for departmental supervision. The accompanying illustrations show how the equipment has been arranged.

Lathes are divided into two departments, the small and medium sized machines being arranged on the third floor and the heavy lathes on the ground floor. In the small lathe department units are grouped according to their adaptability to turn steel or cast iron gear blanks, shafts, screws, bushing or chuck work. Suspension chains with turnbuckles are mounted over each chucking lathe, to aid in handling the heavy parts. All thread milling, combined bushing, boring, and spiral oil

(*Continued on page* 1158.)



Induced Draft Set With Fan Casing Removed

New Turbine Driven Fan

THE reliability and simplicity of operation of steam turbines make them specially suitable for boiler room service, but their relatively high speed has, until recently, prevented their use for driving induced-draft fans. On account of the large volume of air handled, induced-draft fans usually operate at comparatively low speed.

With the general adoption of high-speed reduction gears, turbine drive for induced-draft fans is becoming more generally used, and a considerable number of geared turbine-driven induced-draft fans are now in operation. Many units of this type have been installed on waste-heat boilers utilizing the heat in the gases from furnaces and cupolas. The accompanying illustration shows a typical induced-draft fan with the fan housing removed. The turbine is built by the Terry Steam Turbine Co., Hartford, Conn., and the fans are built by the Green Fuel Economizer Co.

Realizing that lack of care is responsible for many easily preventable accidents, the Abrasive Wheel Manufacturers recently appointed a committee to draft a safety code to govern the use of abrasive wheels. This code is to be used as the foundation for uniform state laws and insurance rules in an effort to reduce the number of accidents and to eliminate much of the confusion now caused by conflicting laws and regulations. The Star Corundum Wheel Co., Detroit, has issued a bulletin containing the complete safety code drafted by the committee. Protection flanges, hoods and chucks are strongly advocated. About half the booklet is given over to a list of general safety requirements. The causes of grinding wheel accidents are tabulated, showing that practically all failures are caused by ignorance or careless mounting.

The High-Speed Hammer Co., Rochester, N. Y., is distributing a 20-page pamphlet, illustrating and describing riveting hammers. Pedestal type, semi-pedestal type and motor-driven hammers are illustrated and described and a few simple instructions are offered for operating motor-driven equipment.

Railroad Shop Equipment

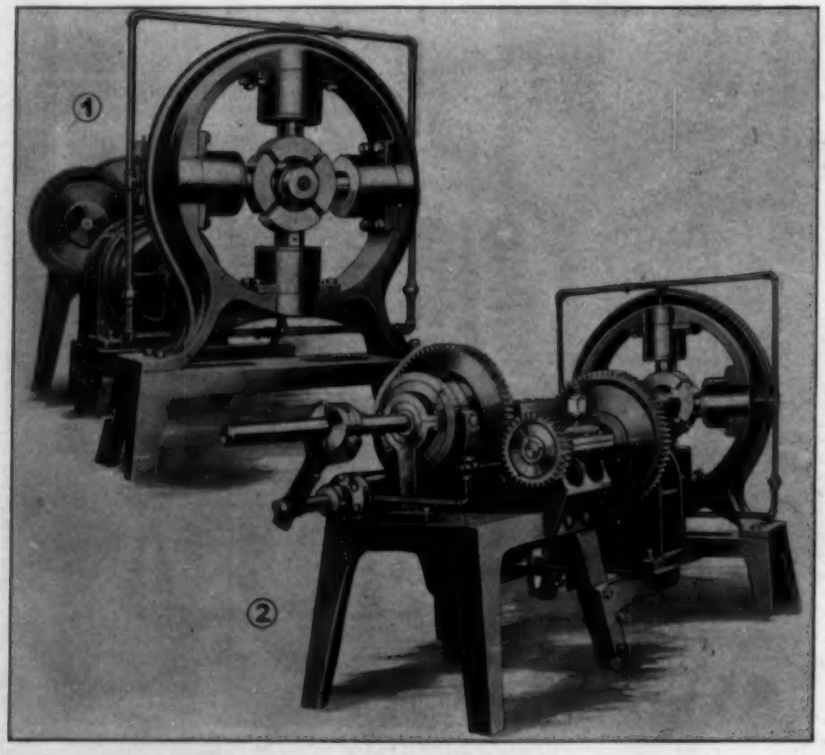


FIG. 1—FRONT VIEW OF WELDER SHOWING HEATING FURNACE
FIG. 2—THREE QUARTER VIEW OF WELDING MACHINE SHOWING GEARING

THE universal flue welder, manufactured by the Southwark Foundry & Machine Co., Philadelphia, is said to embody in its design the essential features to meet conditions that have arisen since the general adoption of the locomotive superheater. Longer and heavier safe ends, which are applied to the superheater flues, make it necessary to support the end while it is being heated and avoid any unusual movement in the transition from the heating furnace to the welding operation. The location of the furnace immediately in front of the welding mandrel is said to effect considerable time and heat saving in transferring the flue to the welding machine. A device on the Southwark welder allows the working of the weld on the inside instead of on the outside of the tube.

The clamping head at the front and the driving mechanism at the back are the two main parts of the machine. The clamping head is made from one circular casting, four air cylinders being mounted on the inside. The pistons are fitted with metal snap rings, and the front end of the piston rods is equipped with sectional dies. These clamp the outside of the

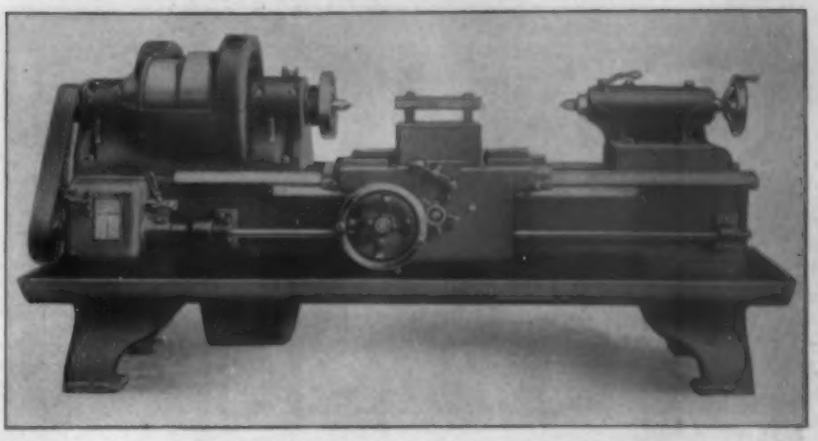
flue at the line along the weld.

The cylinders are piped up to a single air line, and operate simultaneously with the opening of the valve. Running through the center of this head longitudinally with the machine is the welding mandrel which fits the inside of the flue. The mandrel is operated by an air cylinder also controled by the main foot valve. The main mandrel is driven through two gear reductions by a 1½-horsepower motor. An adjustable platform in front of the welder head, which supports the welding furnace, permits the proper location for different lengths of safe ends. A cast iron tank or water back protects the welding head from excessive heat from the furnace. The size of the mandrel, back of the welding rollers, approximates the inside diameter of the flue. This supports the weight of the safe end while being heated and moved to the welding position, which prevents any loss due to the dropping off of safe ends. Standing away from the furnace, the operator uses a foot valve which controls the entire operation of the welder. The piping is so arranged that the clamping heads close in on the outside diameter of the flue before the taper mandrel expands the rollers to make the weld. The mandrel is started by an air chuck operating automatically with the clamping of the flue and is direct driven.

The rapid and almost universal adoption of all steel equipment in railroad rolling stock has created the need for a powerful press to be used in reclaiming bent and damaged parts of wrecked cars from the scrap heap.

The base of the press manufactured by the Southwark company is a heavy steel casting with a flat surface which forms the foundation for the frame, consisting of two uprights which support a main cross frame. The top of this framework is braced by tie rods attached to the four corners of the base platen. The pressure cylinder is suspended from the cross frame by means of a four-wheel carriage. The travel of the ram is controled by means of a four-way valve. The carriage is propelled backward and forward across the top frame by an endless chain traveling over sprockets.

The guide for the piston rod is held between two angle irons fastened to the vertical columns. The piston of the pressure cylinder is 20 inches in diameter and has a stroke of 36 inches. The end of the piston rod is fitted with a die which can be changed in a manner similar to the die of a steam hammer. Air is supplied to the double-acting cylinder by flexible hose connections so arranged and sufficiently long to permit free movement of the cylinder as it travels across the table. The machine is used for straightening bent truck frames, center and side sills, side sheets, channels, angles and truss-rods.



21-INCH HEAVY-DUTY MANUFACTURING LATHE

Develops Heavy-Duty Manufacturing Lathe

The 21-inch, heavy-duty manufacturing lathe, shown in the accompanying illustration, has been designed for heavy-duty, plain, taper and form turning. This machine, which is built by the Himoff Machine Co., New York City, is a development of a tool originally built for shell turning. The general design is in accordance with the latest type of box section construction.

The feeds are chain driven and five cutting speeds are provided by substitution of intermediate gears. The saddle is driven by a splined shaft operating through a worm gear. A friction cone is also employed to avoid the danger of breakage through negligence of the operator or through accident. The cross slide is equipped with a standard European tool post which will carry two or more tools at one setting. An adjustable collar is provided on the splined shaft which may be set for each operation so that when the apron strikes the collar a positive jaw clutch in the gear box is released, stopping the movement of the carriage. When the saddle is moved back, the clutch automatically engages.

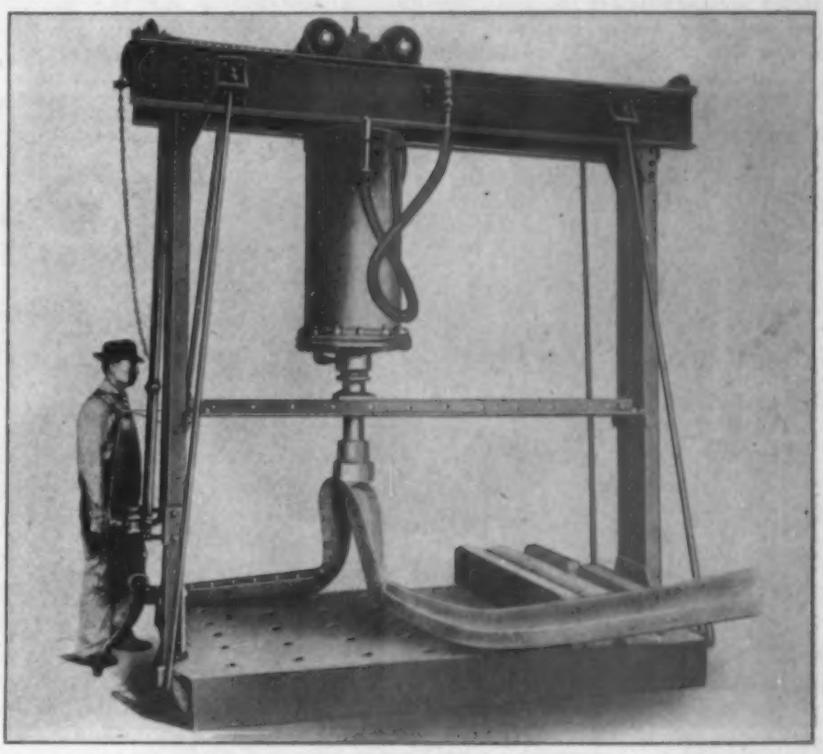
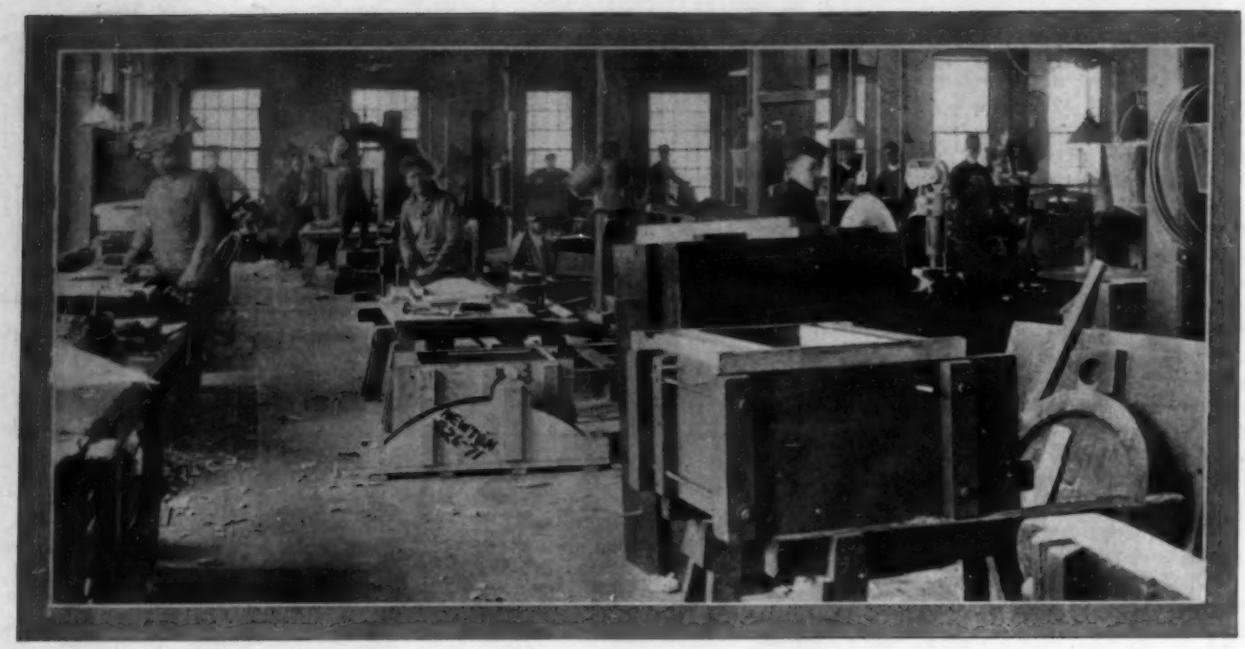


FIG. 3—STRAIGHTENING CENTER SILLS OF STEEL CAR FRAMES



PATTERN SHOP OF THE NEWTON MACHINE TOOL WORKS

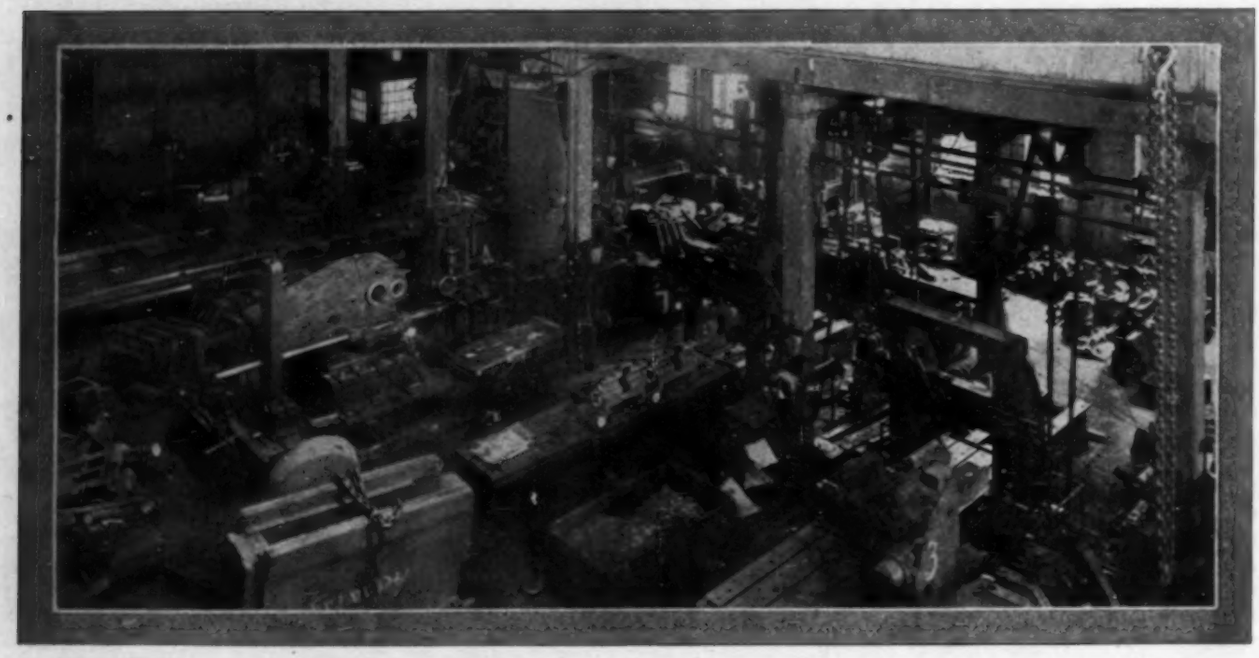
Newton Makes Changes

(*Continued from page* 1155)

grooving, screw machines and turret lathes are also located on the third floor. Elevators at either end of the building, facilitate the handling of material from one floor to another. All heavy material is received on the first floor and progresses east to the shipping department which has a railroad spur.

In shop section No. 1 at the west end of the plant are located the heavy planing and floor boring machines; shop section No. 2 adjoining, contains the portable floor boring, drilling, milling and slotting machines, which are all mounted on a floor plate system which is said to be unique in design. On either side of these tools are located the heavy lathes, spur and bevel gear, worm cutting, milling machines, key seating, milling and slotting machines, vertical boring and turning mills, tire expanders, worm and worm wheel, sand lopping machines. Section No. 3 is entirely devoted to erecting. This division of the plant has one main and two side bays which are equipped with traveling cranes. The lifting equipment in the main bay has a clear travel from one end of the plant to the other.

The engineering and administration departments are being equipped with modern labor saving devices. This department will be located on the top floor of the plant to take advantage of the day light. While not shown in the accompanying photographs the works include an adjoining building, in which are installed power plants, forges, steel storage space, etc. Pattern storage buildings are adjacent to several iron foundries, which are operated under contract, by the Newton company.



PLANING AND BORING MILLS IN THE HEAVY MACHINERY DEPARTMENT

Making the Rolling Mill Possible

The Birdsboro Steel Foundry & Machine Co. Has Recently Completed a Number of Extensive Improvements to Its Plant and is Equipped to Produce Rolls of Any Size

WITH the facilities for making sand, chilled iron and steel rolls from the smallest to the largest now in use, the new roll shop of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., recently completed, is a notable addition to the roll-making industry of the country. The plant is equipped with a full complement of patterns and its melting department has a large capacity. The roll finishing shop is provided with modern machine tools, including roll lathes of the type recently designed by the Birdsboro company for the general market. The plant is located in a large building designed especially for the manufacture of rolls, and the ground plan of the establishment is such that all operations may be performed consecutively, without rerouting the work back through the plant. In addition to inaugurating the roll shop, the Birdsboro Steel Foundry & Machine Co. recently has enlarged its steel foundry, machine shop and erecting department. All of its building have been provided with railroad connections and other improvements made which it is believed place it in the front rank among manufacturers of hydraulic and steel works machinery, blast furnace, steel works and rolling mill castings.

An interesting unit of the melting department is a 25-ton natural draft air furnace, shown in Figs. 2 and 3, the construction of which embodies several improved features of recent development. The principal departure from the usual design is the elimination of the end charging door. Instead, access to the interior of the furnace is had by means of a removable roof, as shown in Figs. 2 and 3. Another novel feature is the location of the tap hole in the center of the furnace; the floor of the hearth, instead of sloping down toward the bridge wall, as is usual, slopes down from both sides to the middle. The construction of the hearth, therefore, is similar to that in the usual open hearth furnace and the general arrangement is shown in Fig. 4. Another valuable modification is the employment of a receiving spout, which makes it possible to return surplus or chilled metal to the hearth. This feature, of course, reduces the wastage of molten metal. The furnace is provided with natural draft by an unusually large stack. This stack is 90 feet high, has an external diameter of 60 inches and is 35 inches in diameter inside the lining.

The use of the removable top, in addition to rendering it easier to repair the interior of the hearth, has effected great economy in the operation of charging the furnace. The charging is done by an overhead traveling crane, shown in Fig. 2, which serves the raw material yard. As a result of the construction and location of the furnace, therefore, it is possible to accomplish the entire operation of charging with the aid

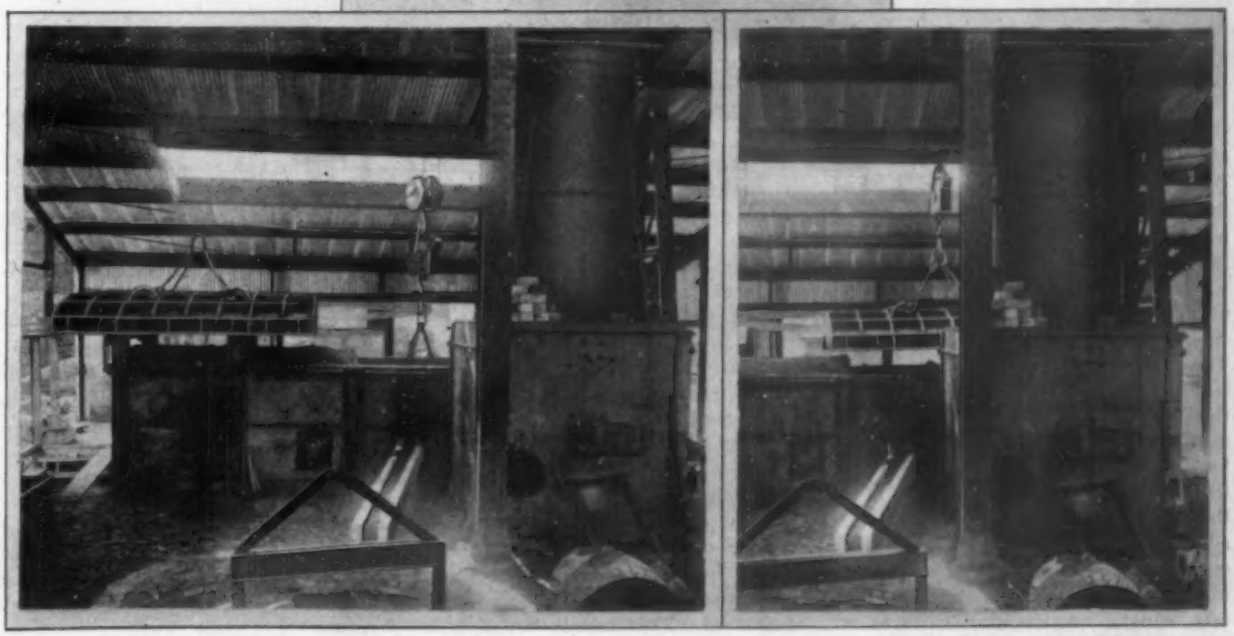


FIG. 1—BIRDSBORO STEEL FOUNDRY & MACHINE CO.'S NEW ROLL FOUNDRY. FIG. 2—FRONT VIEW OF AIR FURNACE SHOWING METHOD OF CHARGING WITH CRANE. FIG. 3—PLACING REMOVABLE ROOF ON AIR FURNACE

of the crane. The yard crane has a capacity of 15 tons and it is equipped with a 15-ton crane scale, making it possible to transport heavy loads of raw material to the open hearth furnace without loss of time in weighing. Pig iron and small scrap are handled with ordinary dump buckets having a capacity of 2½ tons each, while large pieces are handled singly. It is unnecessary to break up large castings which are to be remelted, unless some of these castings are too large for the hearth; thus the old fashioned method of breaking up scrap and charging the pieces by hand or by means of skids is entirely eliminated. The furnace may be charged to its capacity of 25 tons in 45 minutes by two men with the aid of the crane, whereas it is estimated that by the hand charging method the labor of four or five men would be required at least five times that long.

The fire brick structure of the furnace is 23 feet 5 inches from side to side, and 9 feet from front to back. The interior of the hearth is 6 x 13 feet and the hearth walls are 18 inches thick. The side plates are of cast iron and the buckstays of steel, tied by 1½-inch bolts. The furnace is tied together from side to side since the removable roof makes it impossible to tie from front to back, as is customary. The roof is a solid steel casting lined with fire brick, which sets snugly on the flat surfaces of the front and back walls, and the convex surfaces of the side walls. The weight of the removable roof, when provided with its fire brick lining, is 8 tons. The furnace and stack are built upon concrete foundations.

The furnace is directly fired with coal and embodies no regenerative features. The back wall is provided with four portholes for rabbling. At present the output of the furnace is confined to cast iron. Later it will be applied as well to the melting of steel and alloy steel, and the higher temperatures required in steel melting will be obtained by using oil as a fuel. To this end, the furnace already has been provided with air and oil meters and oil burners have been installed. Cast iron will continue to be melted by coal fire, while in steel melting the oil flame will be employed only after the hearth has been brought to a certain temperature by the use of coal. This contemplated practice is based on the belief that coal will prove a more satisfactory fuel than oil for the lower temperatures, since, by the use of the former, difficulties due to the condensation of oil on the cold hearth walls at the beginning of the heats will be prevented.

A second air furnace, similar to the one just described, now is under construction. When this additional unit is completed, the roll shop will have capacity for melting 50 tons of cast iron or steel simultaneously, not allowing for the output of the cupola, which also is included in the roll shop equipment. This cupola has a capacity for melting seven tons an hour of gray iron or semi-steel. Up to the present time the output of the roll foundry's melting department has been cast iron exclusively, and roll molds to be cast in steel or alloy steel are poured in the steel foundry, to which they are transferred from the roll foundry. For handling the heats, the roll foundry is equipped with 25-ton crane ladles, for taking the contents of the air furnaces, and with smaller crane ladles for taking molten metal from the cupola. The ladles now in use all are of the side-pour type but bottom pour ladles will be added as soon as the air furnaces commence the melting of steel. The ladle pit located in front of the air furnace is 8 feet deep and 12 feet in diameter; a pit of similar dimensions will be provided for the second air furnace which is now under construction. The roll foundry is equipped to produce all sizes of rolls, from 6 inches in diameter to the largest now in use. The method of making the rolls does not differ materially from that practiced by other leading roll makers, with the exception that the green sand portions of chilled roll molds are made on a jar ramming machine. All sand rolls, whether they are to be made in cast iron, steel or alloy steel are produced by the sweep method. The jar ram method of making the sand portions of chilled roll molds, as illustrated in Fig. 5, comprises no unusual equipment. The pattern is centered on a follow plate, the flask is set on, the sand shoveled in and the mold jolted. The entire roll shop floor is commanded by two electric traveling cranes, one having capacity of 30 tons and the other 10

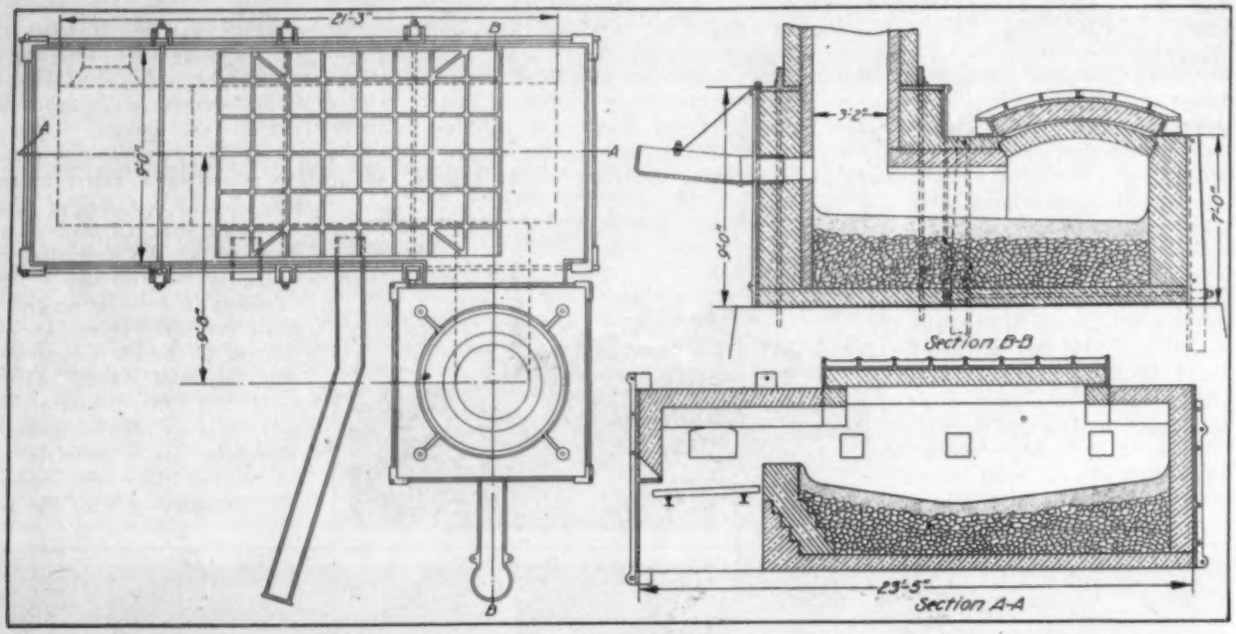


FIG. 4—CONSTRUCTION OF AIR FURNACE, BIRDSBORO STEEL FOUNDRY & MACHINE CO.'S NEW ROLL SHOP

tons. The foundry is provided with two mold drying ovens, each 15 x 33 feet and 14 feet high. Each oven is equipped with a steel truck 13 x 26 feet and of exceedingly heavy construction. These trucks are moved in and out of the furnaces by means of chain blocks operated by a crane. The ovens are coal fired and are provided with natural draft by a stack which is 36 inches in diameter and 70 feet high. All molds, whether they are to be cast in gray iron, steel or alloy steel, are dried in these ovens. For the casting of rolls which are not more than 18 inches in diameter, a huge reinforced concrete pit has been provided. This pit is 40 feet long and 15 feet wide; one portion, which is 12 feet in diameter, has a depth of 22 feet and the remainder of the pit is 12 feet deep.

One end of the roll shop is given over to the roll finishing department. This section is equipped with one 42-inch roll lathe, three 26-inch roll lathes, a large slotter, a shaper for cutting flutes in steel roll, a heavy-duty lathe fitted for cutting sink heads and centering and necking 20-inch and smaller rolls in one operation, a 30-inch, heavy-duty lathe for performing the same operation on larger rolls, one roll grinder with capacity for rolls up to 24 inches in diameter and 120 inches long, one tool grinder, a drill press and other miscellaneous equipment. The roll lathes are of the type which recently has been placed on the market by the Birdsboro company.

The roll foundry is 60 x 240 feet and is of steel frame construction with brick side walls, surmounted at a height of 15 feet by expanded metal and plaster. A large percentage of the wall space is glass. The roof is of slag and of the monitor type. The raw material storage, which is alongside the roll foundry, is commanded by a 10-ton crane, mounted on a runway having a 50-foot span and a length of 300 feet. In addition to handling all iron and steel raw material and supplying the charges for the cupola and air furnaces, this crane is employed for handling sand. The crane is provided with a magnet attachment for handling pig iron and iron steel scrap, and for lifting a skull cracker used for breaking unusually large scrap.

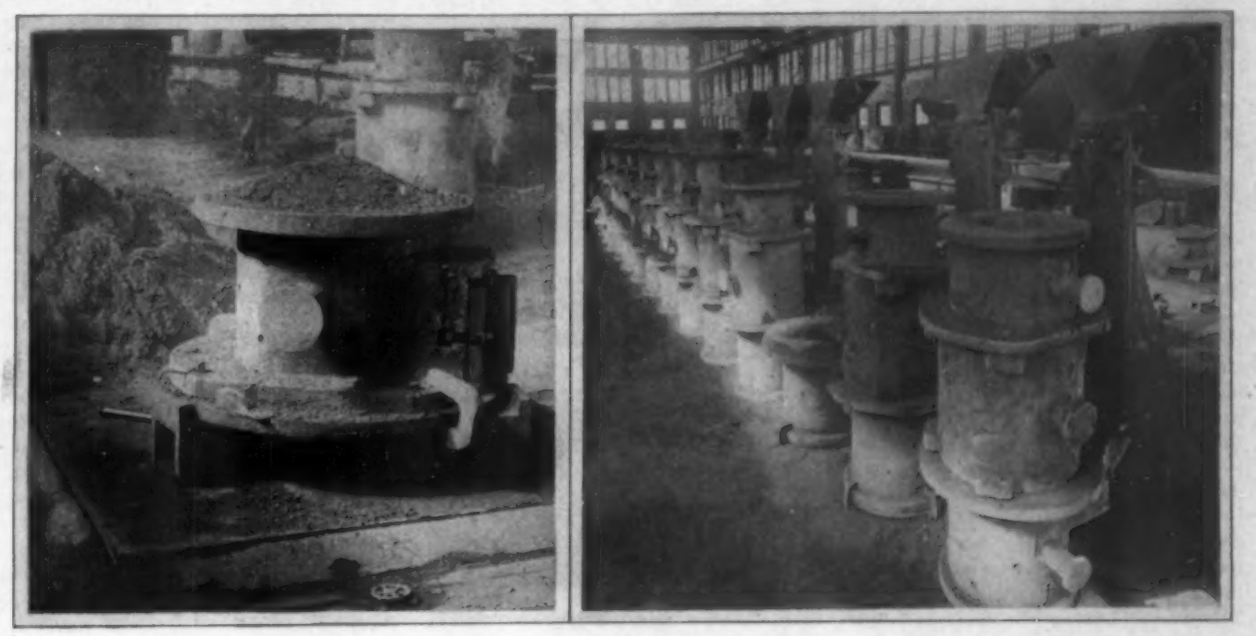


FIG. 5—USE OF THE JAR RAMMER IN PRODUCING SAND PORTIONS OF CHILLED ROLL MOLDS. FIG. 6—FLOOR OF ROLL MOLDS IN PREPARATION FOR POURING

The Birdsboro Steel Foundry & Machine Co. has completed a number of important improvements in various other departments of its plant. In its steel foundry it has installed a hydraulic straightening press which has both horizontal and vertical cylinders and is operated by an electric hydraulic pump. Another important improvement in the steel foundry is the installation of equipment for the use of oil instead of gas as fuel in the open hearth furnaces. The oil is supplied either by a steam or an electric pump, and may be atomized either by air or by steam. Since the use of oil was adopted, the output of the furnaces has been greatly increased. The furnaces, two in number, have a capacity, respectively, of 18 tons and 25 tons per heat; each furnace now produces approximately 20 heats in the time formerly required to produce 13 heats. Another advantage resulting from the use of the oil is that the steel contains less sulphur than when gas was used as a fuel.

Included in other new equipment in the steel foundry is an oil-burning annealing furnace, 8 x 12 feet and 4 feet high, which is equipped with two cars and a front and back entrance, permitting continuous operation. The steel foundry has been enlarged by the erection of a 60 x 60-foot addition, which houses the annealer and the straightening press. This press is used for straightening all kinds of large steel castings, particularly locomotive frames. Two 10-ton cranes have been added to the steel foundry equipment, and one 2-ton crane has been installed over the core department in the steel foundry, making a total of 10 cranes in that shop. The company has constructed alongside the steel foundry a 240-foot overhead runway, which is equipped with a 10-ton, 50-foot span, traveling crane. This equipment is used for handling raw material. An overhead runway, provided with a 10-ton crane, to be used for handling flasks, also has been constructed. Eight sand storage bins, each 30 x 35 feet, have recently been completed. These bins are surmounted by a railroad trestle 18 feet high, and the contents of the cars are emptied into the bins through hatches. Each bin has capacity for holding about six carloads, making the total capacity of the bins about 2,000 tons. The bins are constructed of timber on a concrete base. The

sand is loaded into them in dry weather and kept sealed.

The Birdsboro company recently discontinued its steam power plant, having found it preferable to purchase power from a local service corporation, and a number of rotary converters, to change alternating to direct current have been installed. The new power plant includes a motor-driven air compressor having capacity of 1,500 cubic feet per minute. It has been decided not to dismantle the steam plant, but to retain the steam-driven electric generator and the steam-driven air compressor in case of emergency. The company recently has added a number of large tools to its machine shop equipment, and a track scale, with capacity of 150 tons, recently was completed. An erecting shop, 60 x 120 feet, of the same construction as the roll foundry, also has been added.

Portable Quick Operating Cutter

The usual method of cutting an additional hole in metal lockers has been the source of considerable trouble. An easily operated tool has been invented which can be used for cutting metal, fiber and slate, and can be adjusted so as to cut holes of various sizes with little effort. In using the tool a pilot hole is drilled through the material to be cut and a stud passed through and locked. The knives, which may be adjusted to several diameters, are held in a swing chuck and are automatically fed by means of a spring between the swing chuck and the sham-nut. The accompanying illustrations show the cutter at work on a metal locker. The cutter is manufactured by the Universal Tool & Appliance Co., Stroh Industrial building, Milwaukee.

A court at Valparaiso, Ind., has given a verdict for the defendant in the suit of Nathaniel N. Stone et al. to force the Indiana Steel Co. to return the Grand Calumet river to its former channel and to appropriate a private slip for public use. The court held the plaintiffs had failed to show the Calumet was a navigable stream before the improvement was made by the steel company.

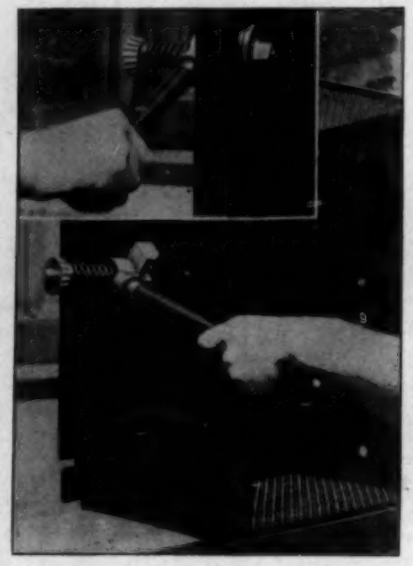
A $500,000 packing house will be erected in this city by the Berry Packing Co., recently organized by B. A. Berry, of Toledo. The exact location of the plant has not yet been decided upon and no plans or contracts for the construction of the building have been let.

Book Review

Elliott's Weights of Steel, computed by Thomas J. Elliott; bound in flexible leather, 662 pages, 5¼ x 9 inches; issued by the Penton Publishing Co., publisher of *The Iron Trade Review,* Cleveland; price $20.

The steel industry has advanced by such leaps and bounds during the last few years that the number and size of orders placed with manufacturers have far outstripped the records of a comparatively short time ago. As the industry expands the necessity for time saving devices is more and more clearly seen. With this need in view "Elliott's Weights of Steel" is offered to all users of rolled steel products.

The book is divided into three parts. Pages 1 to 300 contain tables for finding the weights of 1/16 of an inch to 60 feet in length of rolled steel weighing 1 to 300 pounds per lineal foot; pages 301 to 399 cover the weights of 1/16 of an inch to 60 feet in length of rolled steel weighing 0.01 to 0.99 of a pound per lineal foot; while pages 402 to 662 contain shafting and reinforcing bar tables. The method of using the book is clearly demonstrated by means of examples, although the system of arrangement is so simple that explanation is almost unnecessary. The use of the tables saves a great deal of labor, as it does away with the old, more complicated method of computing weights by arithmetic, and also practically precludes any chance of error.



CUTTER AT WORK ON METAL LOCKER

The weight of a lineal foot of any section of rolled steel can be found in the "Shape Books" of the manufacturers of steel. Having found this weight of a lineal foot of any desired section or plate, the user will simply turn to the page in "Elliott's Weights of Steel" which is numbered the same as the weight of the steel. For instance, if the piece of steel weighs 58 pounds the user will turn to page 58. Then if the piece is 50 feet long he will simply glance at the bottom of the last column and there he will find the weight of a piece of steel 50 feet long, weighing 58 pounds per lineal foot, or 2,900 pounds. If the steel is 50 feet 6 inches long, he will, by a glance at the foot of the first column, ascertain that a 6-inch piece of steel weighing 58 pounds per lineal foot weighs 29 pounds. Then by a simple addition it becomes evident that a piece 50 feet 6 inches long weighs 2,929 pounds. In the case of a fraction of an inch which is represented by hundredths the same system is applied, except that the weight of a piece running 0.09 of a pound per lineal foot will be found on page 309, etc. Pages 403 to 662 give the weights of single pieces of round, square or deformed bars of all dimensions, so that for these sections it isn't necessary even to consult the manufacturer's shape book. To make the handling of the book still more simple, it contains 107 thumb indexes, an average of one to every six pages.

The author's connection with the order department of the Illinois Steel Co. has given him an insight into the practical phases of steel works' office routine that has borne tangible fruit in this volume. The work represents years of patient effort that has been painstakingly and accurately performed for the benefit of steel manufacturers, fabricators, erectors, estimators, architects, engineers, contractors and all others who have occasion to compute the weight and cost of rolled steel products.

A new $100,000 concern, to be known as the McIntyre Motor Co., will be established in Toledo soon. A new type of motor will be manufactured and the company will endeavor to turn out 5,000 motors the first year. W. H. McIntyre, W. D. Rutherford, Elon Gauntlett and C. E. Tracht are interested in the concern. It is planned to have the company in operation by Jan. 1, 1917.

Shortly after Jan. 1, the Pannier Bros. Stamp Co., Fernando street, Pittsburgh, will move its business to Sandusky street, North Side, where the company recently completed the erection of a 4-story building, 44 x 100 feet. One entire floor will be used exclusively for the manufacture of steel stamps. The company will occupy the entire building.

Iron and Money: Fact and Comment

Call Money Rates Jump to Highest Level Quoted in New York Since 1912—Speculation in Stocks Becomes Less Excited

FINANCIAL interest is concentrated on the money market. Call money rates have risen sharply the past few days—just why, nobody seems to know, although the commonly accepted theory is that the big Wall Street banks are curbing speculation by increasing rates and placing greater restrictions on collateral. It is asserted that by this means is avoided a continuance of the recent reckless speculation, which could only end in general disaster. Enormous as the supply of liquid capital is, the drain has been so great that it has begun to be felt. The reserves of the New York banks have been drawn down to a level below which it would be dangerous to go. This drain is reflected, of course, in the money rate—the market's most sensitive nerve. Call rates touched 15 per cent in New York Monday, the highest level since 1912.

Aside from the flurry in the money market, little actual change is to be noted in the business situation. Now, as for months past, the real feature has been the insatiable demand for steel metals, both from foreign and domestic consumers. As time wears on, the upward movement, instead of being checked by curtailed consumption, seems to take on new life and proceed more vigorously. Bessemer pig iron has sold at $35, valley, and predictions of higher levels soon are heard. Some people already have begun to talk about $50 iron if present conditions continue. Such prices mean increased profits for companies which are secure of their raw material, although costs have increased appreciably.

But Wall Street has been surfeited with talk of profits. Reports of this company or that earning $50 to $100 a share on its common stock no longer are sufficient to send the stock skyward. Speculators are beginning to dwell at greater length on their favorite's possibilities as a peace stock than of the profits it is reaping from a shell contract.

The submarine question has come to the fore again, but there is no reason to suppose that it will be taken more seriously than before. The sporadic peace rumors still are springing up, but with no more apparent foundation than those of last spring. In fact, some big steel men say the end of the war looks further away than ever.

Steel and industrial stocks changed little the past week. Some of them scored slight declines, but decreases for the most part were fractional, while some shares gained. Quotations of a number of iron, steel and industrial shares at the close of the New York stock exchange Dec. 2 and net changes for the preceding week follows:

	Close Dec. 2.	Net chg.
American Can	63⅜	— ⅜
American Can, prfd.	114½	+1
Amer. Car & Fdy.	75	— ½
Amer. Car & Fdy., prfd.	118	+ ⅛
American Locomotive	91	—1⅛
American Locomotive, prfd.	108½	+ ⅛
American Steel Foundries	67¾	— ¾
Baldwin Locomotive	76⅞	—7¾
Baldwin Locomotive, prfd.	108	+ ⅜
Bethlehem Steel	620	—30
Bethlehem Steel, prfd.	160	+5
Colorado Fuel & Iron	57¾	—1¼
Continental Can	100	— ⅛
Continental Can, prfd.	114	+1
Crucible Steel	84⅛	—4⅜
Crucible Steel, prfd.	124	+1½
Gulf States Steel	173	—7
Gulf States Steel, 1st prfd.	113	—2
Gulf States Steel, 2nd prfd.	175	—5
International Harv. of N. J.	124	—5
International Harv. Corp.	84½	+ ⅝
Internat'l Harv. Corp., prfd.	112	+ ⅜
Lackawanna Steel	103¾	—1½
Nat'l Enamel'g & Stmp. Co.	33¼	—1¼
Pressed Steel Car	84	—1⅜
Pressed Steel Car, prfd.	107⅛	— ⅛
Pullman Palace Car	166	— ½
Republic Iron & Steel	89½	—1⅜
Republic Iron & Steel, prfd.	115¼	+ ⅞
U. S. C. I. Pipe & Fdy. Co.	25½	—1
U. S. C. I. P. & F. Co., prf.	64	—1⅛
United States Steel	126	— ¾
United States Steel, prfd.	121¾	+ ⅜
Westinghouse Mfg.	63½	—1⅜

Maximum quotations for a number of leading iron and steel securities not listed on the New York stock exchange as of Dec. 1 and Nov. 25, follow:

	Dec. 1.	Nov. 24.
American Radiator	425	425
American Ship Building	67	70
Cambria Steel	134½	130
Chicago Pneumatic Tool	76½	73
LaBelle Iron Works	94	94½
Lake Superior Corp'n	32½	29¼
Stewart-Warner Speed. Co.	106½	109
Warwick Iron & Steel	9¾	9¾
Westinghouse Air Brake	166	162
Westingh'se Elec. & Mfg. Co.	64⅞	65¼

Control of Stamping Company Changes

Control of the American Tube & Stamping Co., Bridgeport, Conn., has passed into new hands. The board of directors was reorganized Nov. 27, as follows: Chairman, J. V. W. Reynders; president, C. D. S. Miller; treasurer, Guy P. Miller; vice president, W. R. Palmer, Charles G. Sanford, William L. Abbot, K. Kingsbury Curtis, V. Everitt Macy, F. J. Kingsbury and William R. Webster. Treasurer Miller has issued the following statement:

"The first consideration of the new owners will be to strengthen and safeguard the property so that it may successfully meet the keen competition that will have to be met by steelmakers after the termination of the war. Many circumstances have combined to prevent the company from producing earnings in keeping with the excellent facilities provided in the way of new open hearth steel furnaces, rolling mills. Particular attention will be given to the steelmaking departments with a view to increasing production in all departments, thus reducing all manufacturing costs."

The company was organized in 1899, absorbing the Wilmot & Hobbs Mfg. Co. in 1901. Its capital stock outstanding amounts to $2,800,000, equally divided between preferred and common. Bonds outstanding amount to $500,000, due 1921. The company manufactures open hearth steel billets, hot and cold rolled hoop, band strip, bar steel, etc.

National Acme Reorganizes

Stockholders of the National Acme Mfg. Co., Cleveland, on Monday, Dec. 5, voted formal approval to a reorganization plan as previously announced. The National Acme Co., an Ohio corporation, with a capital of $25,000,000 in shares of $50 par, will succeed the present company. Present stockholders receive $150 in cash and five shares of the $50 stock for each share now held. This will give them $7,500,000 in cash and $12,500,000 par value of the new stock for the $5,000,000 National Acme common now outstanding. The preferred stock is to be retired. Eastman, Dillon & Co., eastern bankers, have underwritten the remainder of the stock. The price has not been officially announced. No change will be made in the staff of officers for at least five years to come.

Reference has been made in a previous issue of *The Iron Trade Review* to a large manufacturing plant which is being erected by the company on East 131st street. The complete contract has been let to the Austin Co., Cleveland.

Autos Stored

And Factories May be Closed on Account of Car Shortage

Detroit, Dec. 4.—Suspension of operation on the part of some of the city's many automobile factories is threatened by the prevailing shortage of freight cars, according to statements made by the National Automobile Chamber of Commerce following a meeting in the Detroit board of commerce. Statements by the national body also disclosed the fact that $10,000,000 worth of automobiles are now stored in Detroit factories awaiting shipment with not enough railway rolling stock available to handle the shipments.

The meeting was called to formulate plans for meeting the situation and it was decided to appoint two committees to confer with railway officials throughout the Central Freight Association territory as well as in the east to urge compliance with the interstate commerce commission's recommendation that automobile-carrying cars be returned to their originating lines.

Prominent motor car industries of Detroit are represented in the personnel of the committees and the men chosen are those best able to handle the situation and keep the products of the motor plants moving. Those appointed are: H. R. Moule, Chalmers Motor Car Co.; A. C. Westfall, Cadillac Motor Car Co.; H. M. Newlin, Maxwell Motor Car Co.; Walter L. Pierce and J. R. Graham, Reo Motor Car Co., Lansing, Mich.; C. W. Eggers, Willys-Overland Motor Car Co., Toledo.

Mr. Eggers declared at the close of the meeting that there were approximately 30,000 automobile freight cars in the Central Freight Association and eastern territory that are now being used for traffic other than motor cars. He said that the principal business of the committees would be to bring about an observance of the interstate commerce commission's request that all automobile-carrying freight cars be returned to their home lines as soon as possible. "Unless we can get favorable action it will mean that some motor plants will close," said Mr. Eggers.

Serious in Canada

Toronto, Dec. 4.—The car shortage question has become so serious that the Dominion railway commission will hold an inquiry into it, beginning at Toronto on Dec. 11. An application has been made to the commission by the Canadian Pacific, Grand Trunk, Michigan Central and other railroads for an order increasing the demurrage charge from $1 to $4 per car for each day a car is held after the time limit allowed. It is stated that Canadian railways are receiving about $90,000 per month in demurrage charges. The railways say they do not want the demurrage, but need the cars to carry on business.

The Steel Co. of Canada is threatened with a stoppage of operations at its Hamilton plant owing to a shortage in the supply of coke. The furnaces are now running on a reduced tonnage. No improvement in conditions is expected until the close of navigation, when the movement of coal to the lower lake ports will cease, leaving more cars available. The Steel company is one of the largest concerns engaged in munition-making.

IRA NELSON HOLLIS

President-Elect Hollis

Ira Nelson Hollis, president-elect of the American Society of Mechanical Engineers, and president of the Worcester Polytechnic Institute, was born in Mooresville, Md., in 1856. He received his early education in the public schools of Louisville, Ky., and in 1874 was appointed cadet engineer at the U. S. Naval Academy, from which he was graduated in 1878. Two years later he was commissioned assistant engineer in the United States navy, and in 1888 passed assistant engineer. He resigned from the navy in 1893 to accept an appointment as professor of engineering at Harvard University, and in 1913 was called to his present position.

During the 15 years after graduation from the Naval Academy, he served in various positions connected with the design, inspection and operation of marine machinery, and was chief engineer of two ships.

Dr. Hollis received the honorary degree of Master of Arts from Harvard University in 1899, the degrees of L.H.D. from Union College in the same year, and the degree of Doctor of Science from the University of Pittsburgh in 1912.

He was elected to membership in the American Society of Mechanical Engineers in 1884, and was vice president of the Society from 1911 to 1913. He is at the present time serving on the Committee on Constitution and By-Laws.

He is a Fellow of the American Academy of Arts and Sciences, and a member of the Society of United States Naval Engineers, the American Society of Naval Architects and Marine Engineers, the Boston Society of Civil Engineers, and the Society for the Promotion of Engineering Education.

Large Coal Land Deal

Whitesburg, Ky., Dec. 4.—One of the largest coal land deals consummated in eastern Kentucky in 12 months was closed last week when R. D. Baker, Winchester, Ky., Robert C. Reams, J. L. Kammerer, M. C. Cramer and others, of New York City, sold to the Stagg Coal Corporation, of Virginia, some 7,000 acres of rich undeveloped coal lands lying along Carr's fork, Lott's creek and Troublesome creek below here near the Letcher-Perry line, a large part of which lies contiguous to the Louisville & Nashville main line. The initial work of development is to be fairly well under way early in the new year. It will consist of building tramways, opening roadways, grading streets, opening of mines, building tipples, commissaries, miners' houses, power plants, welfare buildings, etc., in which many men will be employed. Good sized towns will be built in which the thousands of miners ultimately to be employed will have homes. Y. M. C. A. and other welfare buildings will be among the first on the ground. It is expected that it will also be necessary for the Louisville & Nashville to build two or three short line branches of road.

The Warren City Tank & Boiler Co., Warren, O., has increased the wages of its employes about 15 per cent.

MEN OF MACHINERY TRADE

Who they are Where they are What they are doing

AMBROSE SWASEY, president of the Warner & Swasey Co., Cleveland, machine tool builder, and John A. Brashear, Pittsburgh scientist and former president of the American Society of Mechanical Engineers, left a week ago for an extended pleasure trip through the far east. The itinerary of the trip includes Japan and China, and the party does not intend to return to the United States until after April 1.

J. Harlan Billings has been appointed lecturer in charge of the machine design department, University of Toronto, Toronto, Can.

B. L. Mallory, formerly connected with the Triple Die & Tool Co., Cleveland, has resigned his position and intends to go in business for himself.

Charles B. Rearick, vice president and manager of the Covington Machine Co., Covington, Va., has moved his headquarters from New York to Covington.

L. H. Blood, mechanical superintendent of the Wood & Brooks Co., Buffalo, N. Y., has become associated with the Lodge & Shipley Machine Tool Co., Cincinnati.

H. O. C. Isenberg, formerly connected with the Ferro Machine & Foundry Co., Cleveland, has accepted a position as chief engineer with the Scripps-Booth Co., Detroit.

R. S. Ramsey, formerly with the Pressed Steel Car Co., has accepted a position as manager of the Bellwood Mfg. Co., founder and machinist, Bellwood, Pa.

J. H. DeVere, general manager of the Ohio Elevator & Machine Co., Columbus, O., has been elected vice president of the Elevator Manufacturers' Association of the United States.

R. H. Carlisle, of Strong, Carlisle & Hammond, machine tool and mill supply dealers, Cleveland, plans to take an extended trip through the west for his health.

J. G. Swain, formerly superintendent of power and machinery of the Northern Ohio Traction Co., Akron, O., has resigned and accepted a position as head of the rim department with the Firestone Tire & Rubber Co., Akron, Ohio.

The Terry Steam Turbine Co., Hartford, Conn., announces the appointment of Stephenson & Nichols, Monadnock building, San Francisco, as its representatives in northern and central California and the northern part of Nevada.

L. Neuman, Paris, France, representative of "La Maison Neuman", of France, importer, is making a visit to machinery manufacturers in the eastern part of the United States for the purpose of establishing relations with them after the European war.

Lindsay Somerville, of Charles Churchill & Co., London, Eng., manufacturers of machine tools, has been making a visit to his former home in Worcester, Mass. He was formerly connected with the Crompton & Knowles loom works 15 years ago.

Arthur Harrop, for 14 years salesman for the Corbin Screw division of the American Hardware Corporation, New Britain, Conn., has resigned to become sales manager for the Frank Mossberg Co., Attleboro, Mass., manufacturer of wrenches and tools.

Benjamin E. Bosler, formerly identified with the Cambria Steel Co., Johnstown, Pa., in the position of assistant superintendent of shops, has been appointed superintendent of the mechanical department, Cambria Steel Co.

General Otto H. Falk, president of the Allis-Chalmers Mfg. Co., Milwaukee, has been appointed chairman of the Milwaukee Abraham Lincoln Memorial committee. Plans are in progress to raise a fund for the erection of a monument to Lincoln.

William R. King, formerly connected with the E. S. Jackson Co., agent for the Firth-Stirling Steel Co. in the Pittsburgh territory, has become associated with William K. Stamets, machine tool dealer, Jenkins Arcade building, Pittsburgh.

Walter F. Henly has been appointed New York representative of the Leland-Gifford Co., Worcester, Mass., which has opened a branch office in the Singer building. The Leland-Gifford Co., manufactures high-speed, sensitive, ball-bearing drill presses and heavy drill presses.

Thomas G. Cox has been appointed treasurer of the Mason Machine Works, Taunton, Mass., to succeed W. R. Davenport, who resigned to enter business in New York. Mr. Cox has been with the concern for 23 years as salesman, selling agent and general agent.

Donald Baker, assistant superintendent of the Liberty Fuse & Arms Corporation, Long Island City, N. Y., has resigned his position with that company to become associated with the Williams Mfg. Co., Montreal, Can. Mr. Baker will have charge of the tool room.

Thomas Crowther, of T. Crowther & Co., Boston, dealers in machine tools, has disposed of his interest in that company and formed a new company to handle a similar line. The new concern will be known as the Thomas Crowther Co. and will be located at 19 Pearl street, Boston.

Alden W. Baldwin, formerly identified with the engineering department of the Deane Steam Pump Co., Holyoke, Mass., has accepted a position as instructor of mechanical engineering in the Towne Scientific school, University of Pennsylvania, Philadelphia.

B. A. Brennan, formerly connected with the Westinghouse Machine Co., as contract manager, and later sales manager of the power department of the Bethlehem Steel Co., has resigned as vice president of the Mercantile Trust Co., St. Louis, to become president of the Citizens Co., Baltimore.

G. C. Emmons, formerly connected with the sales department of the Chicago Pneumatic Tool Co. in the Pittsburgh territory, has resigned and accepted a position as head of the efficiency department of the Republic Iron & Steel Co., Youngstown, O., controling the generation of heat and power for all the Republic company's plants in that district.

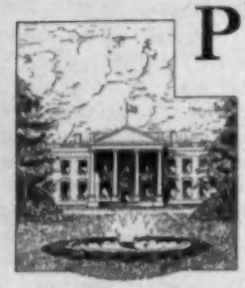
Edwin W. Carpenter, employment agent of the Remington Arms & Ammunition Co., Bridgeport, Conn., has resigned and will organize a company to build machinery and other accessories in that city. His position at the Remington plant has been taken by Joseph A. Holland, formerly connected in a similar capacity with the General Electric Co., Schenectady, N. Y.

B. M. W. Hanson, vice president and works manager of the Pratt & Whitney Co., Hartford, Conn., has been appointed a member of the board selected by Secretary Baker, of the war department. The board will make an extensive examination of the modern types of machine guns and submit suggestions to the war department with regard to the machine gun situation.

Business News of Nation's Capital

Charges for Spotting Ore Cars Will Be Strongly Opposed by Shippers—Awarding of Contracts for Battleships and Battle Cruisers Progressing—Some Interesting Points

Bureau of *The Iron Trade Review*,
206 Corcoran Building,
Washington, D. C., Dec. 5.



PREPARATORY to setting a date for hearing criticisms and objections by shippers, the interstate commerce commission is analyzing proposed tariffs submitted by railroads the latter part of last week governing the transportation of iron ore from lower Lake Erie ports to furnace points in Ohio, western Maryland, West Virginia and Kentucky. These tariffs, being only tentative, carry no I. C. C. numbers, and have been offered for the consideration and approval of the commission in accordance with its order made public last September.

In most respects, they follow closely to suggestions made by the commission, and carry the following proposals:

Changes in line haul rates; assessments of separate charges for dock services; assessment of separate charges for delivery service on private industry tracks at furnaces; change in minimum weight rule; readjustment of consuming districts; assessment of separate dock storage charge of 1c per gross ton per month; straight increase in line haul rate from Toledo, O., to central and southern Ohio and Ashland, Ky., furnaces, amounting to 6c per gross ton on direct and 16c per gross ton on dock ore.

The proposal to increase line haul rates to furnaces in central and southern Ohio and Ashland furnaces causes some surprise. The commission did not order any change in these rates, although it did say they are somewhat low. The advances made are similar to increases at other points, and therefore the rate relationship as between these and other furnaces will be preserved.

Probably the most interesting feature of the proposed tariffs is that which provides charges for spotting cars on furnace trestles. Ranging from 2c to 4c per gross ton, these charges are made applicable to all points where the service is performed by the railroads. The basis upon which they were determined was not detailed in the proposed tariffs. It seems evident, however, that they take into consideration the three points suggested in these columns heretofore, including the volume of shipments, the distance from the breakup yard or interchange tracks to the trestles, and the trestle capacity.

Indications are that this proposed charge will be more strongly opposed by shippers than any other new assessment proposed. It is obvious that such a charge will be an important source of revenue to the carriers hauling the tremendous ore tonnages from Lake Erie docks. The capacity of ore cars varying from 40 to 50 tons and more each, the minimum and maximum charge for this spotting charge will range from 40c to $2 and more per car.

Will Call for Details

The railroads, it is believed, will be asked to show in detail the plan upon which this spotting charge is fixed. The date of the hearing probably will be announced in the near future. Changes in the rates and regulations are to become effective on April 1, 1917, and may be revised considerably when compared with the proposals carried in the tariffs. They are being studied under the direct supervision of Commissioner James S. Harlan, and immediately upon being submitted to the commission were sent to Examiner King, who conducted the ore rate hearings. The commission will definitely fix the future maximum rates, charges, rules and regulations after hearing objections and criticisms of shippers. Some protests are said to be either before the commission now or to be on their way to Washington. It is reported that one of the largest consumers affected has already prepared a protest by letter objecting to the plan of regrouping certain districts, and the spotting and storage dock charges. At the office of Commissioner Harlan, it was said the letter referred to had not been received.

The proposed rates are published in parallel columns in the schedules, showing the charge for each part of the entire service of bringing the ore from the rail of the vessel to the unloading trestle of the furnace. As ordered by the commission, there is a handling charge, vessel to car, of 6c per gross ton on direct ore, a handling charge of 16c per gross ton, vessel to dock, and a forwarding charge from dock to car of 10c per gross ton, on dock ore. The handling charge on direct ore is advanced to 6c from 2c and the dock ore handling and forwarding charge of 26c is advanced 8c and 10c. The storage charge of 1c per gross ton per month is a new assessment, except as to the docks at Erie, Pa., where such a charge is now made.

Battleship Awards

Washington, Dec. 5.—The belief has been expressed at the navy department that the William Cramp & Sons Ship & Engine Building Co., Philadelphia; the New York Ship Building Co., Camden, N. J.; the Fore River Ship Building Co., Quincy, Mass., and the Newport News Ship Building & Dry Dock Co., Newport News, Va., will each offer to build one of the four battle cruisers, bids for which will be opened tomorrow. These vessels, to be of tremendous proportions, each to have 180,000 horsepower, will be a new unit for the United States navy and there had been considerable apprehension that the private builders would hesitate about offering to construct them by reason of the great responsibility they will involve. However, the department now feels that the four companies named will tender bids. The law governing the bids is so drawn that they may be offered with comparative assurance that the builders will suffer no loss. The naval act provides that bids may be made upon a basis of the cost of construction plus a fair and reasonable profit, to be determined by Secretary of the Navy Daniels, and there is an opinion that this plan will be adopted by the expected bidders. According to that act, each battle cruiser shall cost not to exceed $16,500,000, exclusive of armor and armament, which compares with a limit of $11,500,000 each for the four battleships, which were awarded last week, two each going to the New York Ship Building Co., and the Newport News Ship Building & Dry Dock Co.

When the battle cruisers are awarded, there will remain three scout cruisers, and one ammunition ship to be

let in connection with the 1917 building program, which carried a total of 66 vessels. Awards made during the past week, in addition to the four battleships, included one scout cruiser, which went to the Seattle Construction & Dry Dock Co., Seattle, Wash., at $4,975,000, delivery to be guaranteed within 30 months, 27 coast submarines and two 800-ton submarines.

Submarine Awards

Eighteen of the coast submarines were assigned to the Electric Boat Co., of the type for which the price bid by them was $697,000 each. Six were awarded to the Lake Torpedo Boat Co., of the type for which the price bid was $694,000 each. Three vessels of the same type were assigned to the California Ship Building Co., its bid upon the Lake designs being $698,000 each. Of the two 800-ton fleet submarines, one went to the Electric Boat Co. at $1,189,000; the other to the Lake Torpedo Boat Co., at $1,195,000 each. In each case, Secretary Daniels said, the bidders did not fully meet the department's wishes as to minor features of the vessels, and in closing the contracts the department will insist upon the incorporation of some of these features. The bids are all, however, close to the legal limits of cost, it was explained, which are $700,000 for the coast submarines, and $1,200,000 for the 800-ton submarines. The time named by the bidders was also greater than the department desired, as it will be nearly two years before delivery begins. In view of the high prices and long delivery periods named by the bids, Secretary Daniels said he had considered seriously rejecting all bids and undertaking to "rush the program to completion in navy yards."

There was a third 800-ton submarine authorized in the 1917 program for which bids were not invited. This vessel has been ordered built at the Portsmouth, N. H., navy yard, Mr. Daniels stated, "so that of the three more or less experimental 800-ton vessels in this year's program, one will be built by the government upon its own plans, one by the Electric Boat Co., upon its own plans to meet the general requirements of the government, and the third by the Lake company under the same conditions."

The bid of the Seattle company was the only one in connection with the four scout cruisers which carried a direct price, the other bids being complicated by conditions, which Secretary Daniels said could not be considered. The bid of the Seattle company originally carried a condition that it would build a scout cruiser provided it could get the material. This provision was eliminated after assurance had been given the Seattle company that it could secure the required steel. The bids on the remaining three scout cruisers having been unsatisfactory, the department has accordingly issued a new advertisement for bids, to be opened on Jan. 3. The limit of cost for these vessels is $5,000,000 each. Bids for the ammunition ship are to be opened on New Year's day, according to an announcement by the navy department. Whether this holiday was named by inadvertence or not, is not known. In any event, indications are that the award for the ammunition ship will go to a navy yard.

The awarding of two battleships each to the New York Ship Building Co. and the Newport News Co., was in line with general expectations. The contracts are understood not to have been formally signed yet, but they were officially announced by Secretary Daniels. They were held up pending the successful efforts of the secretary to have the ship builders so revise their bids that they would assume the responsibility of obtaining and installing the electric drive machinery specified by the department. It was proposed by the original bids that the department itself should assume this responsibility.

Options Near Expiration

The awards were made on Nov. 29, when options the two ship building companies held on steel for the vessels were on the eve of expiring. The two ships awarded to the Newport News company will be called the Maryland (No. 46), and the West Virginia (No. 48), both of which will be flag ships, in consequence of which the prices for them are $50,000 each over the figures that would be given for other battleships. The contract prices are said not to have been finally settled because certain details as to the electric drive have not been determined upon. The original bid of the Newport News company on two vessels, however, was $10,375,000 each, with $50,000 to be added for equipping each as a flag ship. Delivery is to be made in 39 and 45 months. The vessels awarded to the New York Ship Building Co., will be called the Colorado (No. 45), and the Washington (No. 49), the contract price for each being $11,450,000, deliveries to be made in 39 and 45 months. Armor plate for the Colorado and Washington will be made by the Bethlehem Steel Co., while the Carnegie company will manufacture armor plate for the Maryland and West Virginia.

Awards for armor plate for the four battle cruisers may be announced when bids for those vessels are opened. Bids for armor tonnage for these vessels were sumbitted at the same time figures for armor for the battleships were offered. The Bethlehem company bid on armor for two battle cruisers, and the Carnegie company and the Midvale Steel & Ordnance Co. put in figures for one each, so it seems virtually certain awards will be distributed accordingly. Each cruiser calls for approximately 3,500 tons of armor. The Bethlehem bid on Class A for the cruisers was $435 per ton, the Carnegie bid $425 and the Midvale bid $440.

Awards to Date

Awards of the 58 vessels of 66 in the 1917 program have been distributed as follows:

Two battleships to Newport News Co., prices not announced; two battleships to the New York Ship Building Co., $11,450,000 each; one scout cruiser to the Seattle Construction & Dry Dock Co., $4,975,000; eight torpedo boat destroyers to Fore River Ship Building Corporation, $1,160,000 each; six to the Union Iron Works Co., four at $1,190,000 each and two at $1,185,000 each; four to the Bath Iron Works at $1,150,000 each, and two to the Mare Island, Cal., navy yard at $968,105 each (estimated); 18 coast submarines to Electric Boat Co., at $697,000 each; six coast submarines to Lake Torpedo Boat Co., $694,000 each; three coast submarines to California Ship Building Co., $698,000 each; one 800-ton fleet submarine to Electric Boat Co., $1,189,000; one 800-ton submarine to Lake Torpedo Boat Co., $1,195,000; one 800-ton submarine to Portsmouth, N. H., navy yard, estimate not given out; one fuel ship to Boston navy yard, one hospital ship to Philadelphia navy yard, and one gunboat to the Charleston, S. C., navy yard, estimates not being given in any of three instances.

May Build New Plant

The Charles W. Morse interests have purchased nearly 30 acres comprising the extensive Eastern Point estate of Henry C. Rowe, New London, Conn., and it is reported they plan establishing a ship building plant, second to none in the United States. The reports are that they will spend $1,000,000 in buildings and machinery for the plant, the output of which will be steel vessels. The location is on the Thames river, famous for the Harvard and Yale boat races, and is ideal for ship building, having deep water and a railroad track in close proximity.

Ship Yards Insist on Buying Tools

Vessel Builders Continue to Issue Heavy Lists While Foreign Inquiries Again Boom—Steel Corporation Enters Pittsburgh Market—Price Advance in Cleveland

ORDERS for machine tools continue to appear in record-breaking volume. As has been the case for a number of weeks past, most of the current business is comprised of small orders issued by concerns in all lines of industry. As a result, the deliveries available on most tools do not show a tendency to improve; the market is still in the hands of the sellers. In addition to the huge volume of business from domestic concerns, foreign purchasers are more active in the New York market. J. P. Morgan & Co. continue to place orders for the allies and a large quantity of foreign business is being placed through other agencies. Representatives of foreign concerns continue to come to this country and among those now actively engaged in closing good-sized lists of equipment are H. Arentz, director of the Copenhagen Floating Dock Co., Copenhagen, Denmark, and B. I. Avilov, representing the Aksai Mfg. Co., Nachitchevan, Russia. Mr. Avilov is staying at the Holland House, New York. Probably the largest single order of the week was a contract for between $200,000 and $300,000 worth of punching and shearing machinery, tool lathes, planers, drills, boring mills, etc., placed by the Standard Ship Building Corporation, 44 Whitehall street, New York. The Sun Ship Building Co., Chester, Pa., was a fair-sized buyer, having entered the market for a few more tools. The Davis-Bournonville Co., Jersey City, N. J., purchased a complete machine shop equipment for an addition which it now is building. The Premier Special Machine Corporation, a new concern which has located in the Frasse building, Canal street, New York, to manufacture dies and fixtures, has bought a complete machine shop equipment. Another buyer of tools is the Worthington Pump & Machinery Corporation. The Philadelphia Steel & Forge Co., Philadelphia, has under contemplation an improvement schedule which includes the installation of electric furnaces, a number of additional cranes, etc. The Newark, N. J., board of education which recently inquired for a considerable number of tools, has decided not to buy at this time, owing to the high prices and the extended deliveries which are quoted. Railroad buying continues to be an unimportant factor in the current activity.

Max Klaas, 298 Broadway, New York, has purchased a plant in Newark, N. J., where he will manufacture cutlery. The Samuel L. Moore & Sons Corporation, Elizabeth, N. J., is to erect a good-sized foundry addition. The Improved Paper Machinery Co., Nashua, N. H., is erecting a large machine shop addition. The Universal Boring Machine Co., Hudson, Mass., is erecting a 3-story addition. The Worcester Pressed Steel Co., Worcester, is about to extend its plant. A new plant shortly will be erected by the Daniel Russell Boiler Works, Boston. The Monarch Metal Mfg. Co., Boston, is rebuilding its plant in Cambridge, Mass. The Nichols & Wright Motor Co., Buffalo, is extending its capacity. The McCoy Iron Works, Utica, N. Y., will erect a large fabricating shop. The M. W. Kellogg Co., Jersey City, N. J., is about to erect an extensive addition. The Standard Tool & Mfg. Co., Arlington, N. J., will erect a new building. Taylor & Co., Brooklyn, are about to erect a good-sized foundry addition.

Equipment Demand Heavy

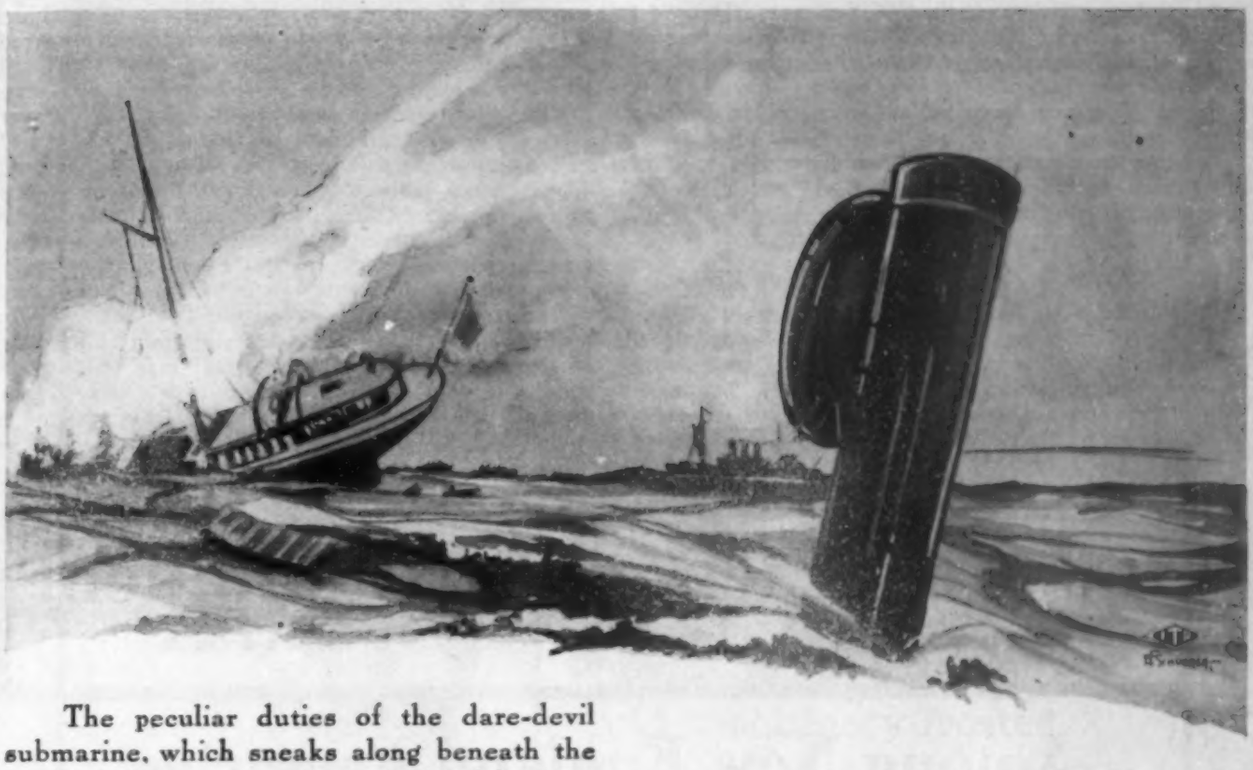
INCREASING demand for machine tool equipment is being received by dealers in the Chicago district. Most of the inquiries result in orders, though late delivery prevents closing in some instances. The business is of substantial character. In many instances buyers are willing to wait several months. Most of the inquiries are for single tools or small lots. No large equipment orders are current. Second hand machinery is moving well, although there is not the same demand for the poorer grades as a year ago. Railroads are buying some shop equipment, though in small lots. The Chicago, Rock Island & Pacific railroad, F. D. Reed, purchasing agent, Chicago, is inquiring for one 18-inch engine lathe, one 42-inch vertical boring mill, one 36-inch drill press and one 48-inch motor-driven vertical boring mill. The Santa Fe has issued additional inquiries for wood-working equipment. The Ingersoll Milling Machine Co., Rockford, Ill., is building an addition to increase its facilities. It is taking orders now for delivery next August. Milwaukee manufacturers are booked far ahead.

Corporation Buying in Pittsburgh Territory

BUILDERS of heavy rolling mill equipment and sellers of machine tools at Pittsburgh are entering the last month of the year with enough actual orders on their books to keep them busy well into the year of 1917. While not many large single inquiries are pending, yet no diminution in demand is noted. Subsidiary companies of the United States Steel Corporation, including the Carnegie Steel Co., which is building new plants at McDonald, O., and Clairton, Pa., the National Tube Co., the American Sheet & Tin Plate Co. and the American Steel & Wire Co., are prominent factors in the market for heavy machinery and machine tools. Some second-hand equipment, purchased for the manufacture of shells, is being offered in this territory, and indications are that considerable munition making equipment will find its way to the market as second-hand equipment the next few months. On the other hand, new inquiries are reported for turret lathes and other shell-making machinery.

Cleveland Dealers Notified of Price Change

MANY machine tool dealers in the Cleveland territory closed their fiscal year Friday, Dec. 1. In every case it is stated that November was a very successful month and that the year just closed promised to be one of the largest in the history of the trade. Planers, milling machines, drills and boring mills are finding a ready market. A price change, effective immediately, has been decided upon by an eastern builder of single and multiple drilling machines and a middle western manufacturer of drill and surface grinders. The advance on drilling machines amounts to about 10 per cent; the increase on drill



The peculiar duties of the dare-devil submarine, which sneaks along beneath the surface of the sea on its errands of destruction, demand that the best materials only be used throughout.

AGATHON STEELS

"AGATHON" Chrome Nickel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steels
"AGATHON" Vanadium
"AGATHON" Chrome Steel
"AGATHON" High Carbon
"AGATHON" Special Analyses Steels

Our shipping facilities are favorable to speedy delivery anywhere

AGATHON STEELS are steels of very high quality. They are specially suitable for ***Cams, Crank Shafts, Drive Shafts, Pistons, Transmission Gears, Connecting Rods,*** etc., for ENGINES to be used on land or sea.

"MAKE THEM OF AGATHON STEELS"

The Central Steel Company
MASSILLON, OHIO

Detroit Office: 326-27-28 Ford Bldg., F. Walter Guibert, District Representative
Cleveland Office: Hickox Bldg., The Hamill-Hickox Co., District Representative
Chicago Office: Room 1511-12 Lytton Bldg., 14 East Jackson Blvd., A. Schaeffer, District Representative
Philadelphia Office: 902 Widener Bldg., Frank Wallace, District Representative

J. E. Dockendorff & Co., 20 Broad St., New York, N. Y., General Export Agents.

Steels that can be relied upon

AGATHON STEELS

and surface grinders, about 7½ per cent. The Adel Mfg. Co., New Philadelphia, recently incorporated with $75,000 capital stock, plans to continue the business of the Spicer Mfg. Co., which surrenders its charter. The new company will erect a 150 x 250-foot brick and steel building which will be equipped with a 15-ton traveling crane. A foundry and a modern machine shop will be operated. U. D. Miller, N. W. Judkins, R. W. Emerson, Fred F. Hall and T. B. Stroup are interested.

Good Business Appearing in Cincinnati Market

DOMESTIC orders continue to feature the Cincinnati machine tool market. The Recording & Computing Machine Co., Dayton, O., is purchasing a large list of lathes to equip two new buildings, which will replace those damaged by fire recently. The Cincinnati Sheet Metal & Roofing Co. will need a number of shears, presses and stamping machines for its new plant for which plans are being prepared. The Frankfort Automobile Co., Frankfort, Ind., still has some equipment to be purchased for a new plant for the manufacture of automobiles. Fred P. Beaver, Dayton, O., who is building a factory, 50 x 200 feet, has not purchased all of the equipment required. The National Lathe Co., Cincinnati, is now in a position to ship six lathes a week from the time an order is placed, or 30 lathes first month. A number of other plants report that they are fast catching up on deliveries, and that shipments can be made in almost half the time required at the same time last year. Milling machines and planers are selling readily, deliveries on the former being further behind than on any machine tool manufactured in Cincinnati. Second hand machinery is active because prompt deliveries can be made.

New Construction and Equipment

What it is **Where it is** **Who's doing it**

Among New England Factories

NASHUA, N. H.—The Improved Paper Machinery Co. has commenced the erection of a 3-story, 34 x 72-foot machine shop addition.

BRATTLEBORO, VT. — The S. S. Smith Mfg. Co., maker of toys, has let a contract for the erection of a 40 x 140-foot addition.

BOSTON.—Fire in the Badger building, 81 Wareham street, caused $60,000 damage. The Kohe Mfg. Co., machinist, is one of the occupants.

BOSTON.—Architects Monks & Johnson, 78 Devonshire street, are drawing plans for a 1-story, 70 x 115-foot plant to be erected for the Daniel Russell Boiler Works.

BOSTON.—The Alger Land Trust has let the contract for a brick, mill construction, 2-story and basement, 55 x 106 foot factory at 34 Old Colony avenue, South Boston.

BOSTON.—The Dowling Iron & Steel Co. has been incorporated with $20,000 capital by Martin A. Dowling, George Blaney, Benjamin F. DeCosta and William J. E. Sander.

BOSTON.—The Granite State Tap & Die Co. has been incorporated with $200,000 capital by Walter T. Harrison, president; Charles F. Remington, Charlestown, N. H., treasurer, and L. M. Dunn.

BOSTON.—The plant of the S. A. Woods Machine Co., 32 Damrell street, South Boston, was damaged slightly by fire Nov. 13. The company is engaged in the manufacture of shells.

CAMBRIDGE, MASS.—The Monarch Metal Mfg. Co., 45 Haverhill street, Boston, has started work on the rebuilding of its plant.

EVERETT, MASS. — The General Electric Co. has let a contract for the erection of a 1-story, 115 x 200-foot pattern shop.

GREENFIELD, MASS.—The Greenfield Machine Co. has let a contract for the erection of a 1-story, 50 x 100-foot addition.

HAVERHILL, MASS. — Plans for a new plant for the Gilet Carbonizing Co. are being held in abeyance.

HOLYOKE, MASS.—The Valley Paper Co. will build a brick, 3-story, 60 x 227-foot mill on Bridge street.

HUDSON, MASS. — The Universal Boring Machine Co. is building a brick, mill construction, 3-story, 40 x 60-foot addition to its factory.

LYNN, MASS.—The Electric Welding Co. has been incorporated with $850,000 capital by Daniel J. Lyne, Carl E. Felton and Eugene T. Connolly.

MANSFIELD, MASS.—The Mansfield Foundry Co. has acquired the old Rider foundry here and is about to double its capacity. It has begun work on the erection of a 60 x 100-foot addition.

PITTSFIELD, MASS. — The General Electric Co. has let a contract for the erection of a 1-story and basement, 75 x 175-foot addition.

SOUTH BOSTON, MASS.—The New York, New Haven & Hartford railroad is about to erect a 40-stall round house here.

SPRINGFIELD, MASS.—The New England Westinghouse Co. has let a contract for the erection of a manufacturing addition.

SPRINGFIELD, MASS.—The B. B. Noyes Co. has been incorporated to do a general foundry and machine shop business with $12,000 capital by Winthrop T. Noyes, Gertrude S. Cumming and Margaret T. Noyes.

SPRINGFIELD, MASS.—The Bozart Rug Co. has let contract to Fred T. Ley & Co. for a brick and steel, 2-story and basement, 60 x 300-foot factory to cost $100,000 on Plainfield street. It will be equipped with specially designed machinery, all with direct electric drive.

WATERTOWN, MASS.—The Hood Rubber Co. is building a brick, concrete, wood and steel, 1-story, 96 x 64-foot vulcanizing building on Nichols avenue.

WORCESTER, MASS. — The Worcester Pressed Steel Co. is about to erect a 2-story manufacturing addition, 90 x 170-feet.

WORCESTER, MASS.—The Wyman-Gordon Co. will build a 1-story, 28 x 34-foot addition to its forge shop at 64 Gold street to provide for bar shears.

CENTRAL FALLS, R. I.—The Standard Engineering Works has let a contract for the erection of a 2-story, 65 x 75-foot plant building.

CENTRAL FALLS, R. I.—The Hemphill Machine Co. is erecting an addition which will increase its output of knitting machines by 50 per cent. The addition is to be completed by Jan. 1.

PROVIDENCE, R. I.—The Monahan Vehicle Co. will erect a new plant in the spring.

PROVIDENCE, R. I. — The Franklin Machine Co., 189 Charles street, is about to erect two foundry additions, 34 x 98 and 56 x 140 feet, respectively.

PROVIDENCE, R. I. — The Rhode Island Malleable Iron Works is erecting a 2-story, brick, 60 x 110-foot addition and a wood and concrete 18 x 300-foot addition. A third addition to be 40 x 120 feet, brick and steel construction is also being erected.

WOONSOCKET, R. I. — The Woonsocket Rubber Co. will build a brick, 2-story, 40 x 150-foot addition to its box shop.

BRIDGEPORT, CONN.—The Locomobile Co. of America is about to erect a 1-story, 100 x 160-foot addition.

BRIDGEPORT, CONN. — Geo. S. Youngs Co., Stella avenue, has started work on the erection of a 1-story, 72 x 96-foot foundry addition.

BRIDGEPORT, CONN.—The Electric Cable Co., 480 Bunnell street, has let a contract for the erection of a 4-story, 58 x 130-foot addition.

Preparedness Talks with

ROLLING MILL JIM

Fellows, that cold snap was sure a warnin' of what's coming, and you know what it means to have the rolls and machinery frosted. I must say that the Hubbard Rolls stand this kind of weather better than any of them. Better get the mill dressed for the cold weather.

So long—

Rolling Mill Jim.—

Hubbard Steel Foundry Co.

EAST CHICAGO, IND.

All Kinds of Iron and Steel Rolls and Steel Castings.

Say you saw it in THE IRON TRADE REVIEW

CHESHIRE, CONN. — The plant of the Cheshire Brass Corporation, recently taken over by John E. Liggett, of Liggett, Hichborn & Co., Boston and New York, Russell A. Cowles, vice president of the Buffalo Copper & Brass Rolling Mill, Buffalo, and president of the Metals Trading Corporation, 99 John street, New York, and others, is being enlarged to about five times its former capacity. A new casting shop now is being erected.

FAIR HAVEN, CONN. — The Connecticut Sash & Door Co. will build a fireproof, 5-story, 100 x 100-foot factory at Grand avenue and Mill river.

HARTFORD, CONN. — The Terry Steam Turbine Co. has awarded contract for a brick, 1-story, addition to its plant on Windsor street.

WATERBURY, CONN.—The Chase Metal Works is about to start work on the erection of a 2-story, 100 x 400-foot plant addition.

WATERBURY, CONN.—The Scoville Mfg. Co. has let a contract for the erection of a 1-story, 114 x 116-foot addition.

WATERBURY, CONN. — The American Brass Co. has let a contract for the erection of a 3-story and basement, 50 x 201-foot finishing building.

WATERBURY, CONN. — The Waterbury Farrell Foundry & Machine Co. is about to start work on the erection of a 2 and 1-story, 40 x 80-foot and 35 x 150-foot machine shop addition.

From the Alleghenies to the Sea

BROOKLYN.—Andrew Robinson, 228 North Eleventh street, is receiving bids on the erection of a 1-story, 50 x 100-foot factory.

BROOKLYN.—Taylor & Co., 680 Morgan avenue, has let a contract for the erection of a 1-story, 50 x 200-foot foundry.

BROOKLYN.—Wm. Koenig, 226 Henry street, has had completed by Architect A. G. Carlson, 226 Henry street, plans for an addition to his plant.

BROOKLYN.—The Burroughs Tool Co. has been incorporated to manufacture tools and machinery with $25,000 capital by W. C. and C. W. Burroughs and E. A. Judge, 21 Park place.

BROOKLYN.—The Dunwall Mfg. Co. has been incorporated with $100,000 capital to manufacture bottle stoppers, by R. T. Nelson, G. Hoecker, E. O. Kannofsky, 1329 Seventy-fourth street.

BROOKLYN.—The Safety Night Light Co., 147 Jackson avenue, is having drawn by Architects Laspit & Salvati, 525 Grand street, plans for a 1-story and basement, 50 x 100-foot shop building.

BUFFALO. — The American Radiator Co. has let a contract for the erection of a 1-story, 80 x 100-foot malleable addition.

BUFFALO.—The Nichols & Wright Motor Co., 48 South Division street, will erect a 1-story, 36 x 40-foot plant addition.

BUFFALO.—The Buffalo Foundry & Machine Co. will erect a 1-story, 100 x 116-foot machine shop.

JAMESTOWN, N. Y.—The Crown Metal Construction Co. is about to erect a 1-story plant structure.

JAMESTOWN, N. Y.—The Steelwhite Co. is about to erect a 2-story, 105 x 163-foot manufacturing building.

LOCKPORT, N. Y.—The plant of the Harrison Mfg. Co., one of the largest industries here, has been sold to the United Motors Corporation for $1,000,000. Options also have been taken on available sites and a big addition to the present plant will be constructed at a cost of about $300,000.

MORRISVILLE, N. Y.—The Howe Development Corporation has been incorporated to manufacture mechanical devices with $220,000 capital, by J. A. Johnson and A. L. and C. B. Howe.

NEWBURGH, N. Y.—The Texas Co., 17 Battery place, New York, will build an oil station here to consist of three buildings.

NEW ROCHELLE, N. Y.—Architect N. R. Siegal, Madison avenue and Forty-first street, New York, is drawing plans for a 6-story, 100 x 200-foot addition to the plant of the H. W. Johns-Manville Co., New York, which is to be leased to the Jones Speedometer Co., 32 Thirty-third street, Brooklyn.

NEW YORK.—The Steel Ventilouvre Co. has been incorporated to manufacture ventilators with $500,000 capital, by J. P. Goodhardt, W. C. Lange and C. M. Wills, 25 West Forty-second street.

NEW YORK.—The Merrill Spring Co. is about to erect an extension to its plant.

NEW YORK.—Lehmaier, Schwartz & Co., 207 East Twenty-second street, are about tot erect a 6-story, 25 x 100 and 42 x 100-foot addaddition.

NEW YORK. — The Aluminum Metals & Alloys Co. has been incorporated to refine metals and minerals with $2,000,000 capital by J. S. Greenburg, E. A. Zema and M. Tischer.

NEW YORK.—The Princeton Machine & Tool Corporation has been incorporated to manufacture machinery and factory supplies with $12,000 capital, by M. Raymond, M. Lesoff and M. Samburg, 741 Crotona Park, north.

NEW YORK.—The Westinghouse Convertible Auto Truck Corporation has been incorporated to manufacture motors, supplies and cars, with $10,000 capital by A. C. Dam, J. H. Cardon and J. S. Zelaya, 406 Central Park, west.

NORTH TONAWANDA, N. Y.—Plans for a 3-story, 67 x 102-foot addition to the plant of the Rand Co., are being revised.

NORTH TONAWANDA, N. Y.—The Buffalo Sled Co. is having drawn by Engineer Wm. Steele & Sons Co., 1600 Arch street, Philadelphia, plans for a plant and warehouse to be erected at a cost of about $150,000.

PHELPS, N. Y.—The Bennett Corporation, in which W. J. Bennett, Sietz building, Syracuse, N. Y., is interested, is having drawn by the Kennedy Engineering Co., 120 Broadway, New York, plans for a cement plant to be erected here at a cost of $1,250,000.

ROCHESTER, N. Y.—The Taylor Instrument Co., 95 Ames street, has let a contract for the erection of a 1-story, 20 x 120-foot addition.

ROCHESTER, N. Y.—The Chemical Electric Co. has been incorporated to manufacture batteries with $60,000 capital, by H. E. Evans and H. J. Wood, 1358 Main street, Buffalo.

SYRACUSE, N. Y.—The Durston Gear Co. has let a contract for the erection of a 1-story, 50 x 108-foot manufacturing addition.

SYRACUSE, N. Y.—Plans are being drawn by Architects Faber and Baxter, Gurney building, for a 1-story, 50 x 108-foot manufacturing building, to be built for the Durston Gear Co.

UTICA, N. Y.—Hart & Crouse, 301 Turner street, will build a 100 x 150-foot core shop.

UTICA, N. Y. — The McCoy Iron Works will erect a 1-story, 125 x 400-foot fabricating shop, plans for which now are in progress.

WATERVLEIT, N. Y.—A contract has been let to the C. P. Boland Co., 30 Fourth street, Troy, for the erection of extensive additions to shop buildings at the Watervliet arsenal.

ARLINGTON, N. J.—The Salmond Bros. Co., 526 Elm street, is about to erect a 1-story, 80 x 80-foot shop addition.

ARLINGTON, N. J.—The Standard Tool & Mfg. Co., 237 Laurel avenue, has let a contract for the erection of a 1-story, 50 x 75-foot plant.

CAMDEN, N. J.—The Federal Automobile & Supply Co. has been incorporated with $100,000 capital to equip motor vehicles, by C. M. Reeves, Camden, W. A. Walton, Oxford, and T. R. Roberts, Philadelphia.

ELIZABETH, N. J.—Samuel L. Moore & Sons Corporation shortly will erect a 1-story, 40 x 200-foot foundry addition.

ELIZABETH, N. J.—The Smidth-Lewis Co., just incorporated with $10,000 capital will locate an iron foundry here at North avenue and Meadow street. John J. Griffin, 88 Steuben street, East Orange, N. J., is a stockholder.

HOBOKEN, N. J.—Lehman Bros., 401 Jefferson street, are about to erect a new smelting shop.

HOBOKEN, N. J.—The Elevator Supplies Co. has been incorporated to manufacture war munitions and deal in elevators, with $2,000,000 capital, by E. A. Markley, J. H. Young, J. C. Ralph and R. Cooper, Newark.

JERSEY CITY, N. J.—M. W. Kellogg Co., founder and machinist, has let a contract for the erection of a 1-story, 100 x 105-foot addition.

JERSEY CITY, N. J.—The Air Reduction Co., 50 Broad street, New York, has let a contract to the H. D. Best Co., 52 Vanderbilt avenue, New York, for the erection of a 1-story, 30 x 100-foot plant here.

KEARNY, N. J.—The North American Copper Co., 52 Vanderbilt avenue, New York, is drawing plans for a large new plant to be located on the meadows between Hackensack avenue and the Passaic river.

NEWARK, N. J.—Maher & Flockhart are about to erect a foundry addition.

NEWARK, N. J.—The Standard Oil Co. has let a contract for the erection of a large automobile service building at 96 Ogden street.

NEWARK, N. J. — The Oxweld Acetylene Co. has let a contract for the erection of a brass foundry.

NEWARK, N. J.—Gould & Eberhardt, manufacturers of machinery and tools, have awarded a contract to Frank Hill Smith, for a new plant on Blanchard street to cost $225,600.

NEWARK, N. J.—Barlow Foundry Co. has been incorporated with a capital of $250,000 to

Blackwood Steels

Prepared for you in our immense steel foundry which has such capacity and facilities that you are assured *highest quality work* and *prompt delivery.*

If you wish to know what real satisfaction is, specify our

Case Hardening Boxes
and
Lead and Cyanide Pots

which we are making of specially prepared steel.

Something else you should not neglect—Blackwood

SUPERFINE STEEL CASTINGS

For Automobiles, Auto Trucks and High Grade Machinery

WE ALSO MAKE

Electrical Castings of the highest Magnetic Permeability, and **Castings** made of **special alloys.**

Ask for particulars

The Blackwood Steel Foundry Co.
SPRINGFIELD, OHIO

manufacture iron, brass and other metals by William Fellowes Morgan, Short Hills; Walter Kidde, Montclair; Samuel Dixon, Newark.

NEWARK, N. J.—Essex Precision Tool & Machine Co. has been incorported with $25,000 capital to manufacture mechanical tools by Frank Heid, New York; Irme Lappay, Newark; H. E. Friedrich, Yonkers, N. Y.

NEWARK, N. J.—Max Klaas, importer of cutlery, 298 Broadway, New York, has purchased a plant at 26-32 Kipp street, and will equip it for the manufacture of various kinds of cutlery.

PERTH AMBOY, N. J.—P. White & Sons will erect a 40 x 40-foot boiler and engine room addition.

PERTH AMBOY, N. J.—The Raritan Copper Works has let a contract for the erection of a 2-story, 50 x 60-foot blast furnace building.

PISCATAWAY, N. J.—Chas. Delarne, 27 William street, New York, has let a contract for the erection here of a 1-story, 70 x 300-foot smelting plant.

TRENTON, N. J.—The Modern Aeros Co. has been incorporated with $100,000 capital to manufacture self-propelled vehicles and engines, by L. Lukacs, J. Pedery and A. W. Allyn.

OAKMONT, PA. — The Hall Concrete Products Co. is about to erect a 3-story, 125 x 300-foot manufacturing building.

PHILADELPHIA. — The Columbus Island Co. has awarded a contract for a 20 x 105-foot addition which will be used as a forge shop.

PHILADELPHIA.—The Ridge Avenue Iron & Metal Co. will build a 1-story, 68 x 160-foot machine shop on Twenty-ninth street.

PHILADELPHIA.—The Riverside Smelting & Refining Co., Reynolds street, has let a contract for the erection of a 1-story, 60 x100-foot plant.

PHILADELPHIA. — A large machine shop duplicating the shop recently awarded for the Norfolk navy yard is being planned by the government for the League Island navy yard, this city.

BALTIMORE. — The Baltimore Enamel & Novelty Co. is about to erect a 2-story, 250 x456-foot plant.

BALTIMORE. — The Shawingan Electro Products Co., U. S. Fidelity & Guarantee building, has let a contract for the erection of a plant.

Activities in the Central States

CANTON, O.—The Zahner Metal Sash & Door Co. will build a new plant to cost about $80,000, according to an announcement made recently by E. J. Zahner.

CLEVELAND. — The Cleveland Co-operative Stove Co. has started to erect a factory on Harvard road to cost $125,000.

CLEVELAND.—The Palbro Mfg. Co. has been incorporated with $75,000 capital to manufacture metal products, by E. P. Strong, G. Q. Keeley, F. A. Cook, et al.

CLEVELAND.—Engineers Burchard-Roberts-Wales, Swetland building, are taking bids on a 1-story, 100 x 300-foot factory addition for the Jordan Motor Car Co., to cost $350,000.

CLEVELAND.—F. H. Betz, city architect, will take bids on the excavation and structural steel for the city auditorium in the spring. The building will be 214 x 595 feet, steel frame and reinforced concrete construction. The total cost will be $1,775,000.

CLEVELAND.—G. S. Ryder & Co., engineers, Century building, have applied for a permit for a 40 x 135-foot, 1-story, addition to the plant of the Cleveland Twist Drill Co., to cost $18,000. The company has also applied for a permit for a 4-story, 50 x 89-foot building for the Elliott Parker Electric Co., to cost $30,000.

CLEVELAND. — Architect W. S. Lougee, Marshall building, has awarded to the S. W. Emmerson Co., Engineers building, the contract for a 1-story, mill construction addition for the Osborne Crew Mfg. Co., 321 Frankfort street, the cost of which will be about $14,000.

CLEVELAND.—Engineers W. S. Ferguson & Co., 1900 Euclid avenue, have completed plans for a 110 x 600-foot factory building to cost $150,000. The same engineers are now taking bids on a 2-story, 30 x 60-foot and a 1-story, 160 x 341-foot addition for the Atlas Bolt & Screw Co., to cost $120,000.

COLUMBUS, O.—It has been announced here that the Big Four railroad has purchased a site on which to erect a new round house and repair shop.

DAYTON, O.—The Manufacturers Production Co., Nelson Emmons, president, was damaged to the extent of $500,000 by fire recently.

ELYRIA, O.—The Perry-Fay Mfg. Co. has provided additional capital for the purpose of enlarging its plant.

FREMONT, O.—The Crescent Mfg. Co. announces that it will install additional equipment and will provide factory extensions.

MANSFIELD, O. — The Mansfield Block Washer Co., capital $50,000, will build a 50 x 150-foot plant.

MASSILLON, O.—T. O. Kennedy, general manager of the Massillon Gas & Electric Co. announces that plans are about ready for the expenditure of $250,000 to increase the capacity of the company's plant. A new turbine, two new boilers, coal handling equipment and stokers will be installed.

PORTSMOUTH, O.—The Whitacre-Glessner Co. has decided to install another series of sheet mills in its plant.

WARREN, O.—The Warren City Tank & Boiler Co., B. W. Edwards, secretary and treasurer, will erect a 1-story, 60 x 200-foot addition.

HUNTINGTON, W. VA. — Architect E. T. Ritter, First National Bank building, is taking bids for a 3-story, 58 x 131-foot, $25,000-factory for the Peerless Overalls Co., Charles Watts, president.

WHEELING, W. VA.—The Wheeling Traction Co. plans to erect a new machine shop and to install a large amount of new equipment.

CAMBRIDGE CITY, IND.—The H. & M. Auto Parts Co. has been incorporated with $10,000 capital to manufacture automobile parts, by A. Huddleston, C. J. Marson and O. E. Huddleston.

ELKHART, IND.—The Elkhart Stamping & Tool Co. has been incorporated with $25,000 capital. Directors are Alexander H. Hyndman, Oliver A. Gause and Bert D. Gause.

INDIANAPOLIS. — The Klieber-Dawson Machinery Co. has been incorporated to manufacture machinery with $10,000 capital, by Paul Klieber, and H. W. and J. M. Dawson.

LOGANSPORT, IND. — The Pennsylvania railroad announces $400,000 will be spent for the construction of new shops to accommodate the Pan Handle and Vandalia roads. Ground has been purchased near here.

NEW ALBANY, IND.—R. H. Humphreys & Co. have awarded to Edward Banet the contract for two or three buildings to cost approximately $30,000. The company manufactures wood working machinery.

RICHMOND, IND. — The Richmond Malleable Castings Co. will be ready for operating about Dec. 15. The plant is nearing completion rapidly. Four annealing furnaces will be installed. John M. Lontz is president.

WASHINGTON, IND. — The Washington Plow Co. has been incorporated with $50,000 capital to manufacture agricultural implements, by C. K. Tharp, M. H. Kelly and E. G. Gesell.

ALTON, ILL.—Additions are being planned by the Laclede Steel Co.

CHICAGO.—The Central Manufacturing district of Chicago, has bought and opened to lease 100 acres additional which will be added to the present industrial district on the Southwest side. A central power plant to cost $250,000 will be built at once.

CHICAGO.—The Vortex Co., 420 Orleans street, will build a 4-story plant at Western and Austin avenues.

CHICAGO. — The Chicago Recording Scale Co. will build a plant at Strimg and Madison streets.

CHICAGO.—The plant of John Mohr & Sons, boilermakers, West Illinois street, was burned recently with an estimated loss of $100,000.

DUNDEE, ILL.—Plans are being prepared for a bridge at Main street, costing $40,000. George N. Lamb, Genoa, is county superintendent of highways.

METROPOLIS, ILL.—The Wilson Stove & Mfg. Co. is building a 3-story factory, 90 x 275 feet, to cost $100,000.

NORTH CHICAGO, ILL. — The Chicago Hardware Foundry Co. will build an additional foundry.

PEORIA, ILL.—The Avery Co., manufacturer of agricultural implements, is building a 2-story foundry 50 x 70 feet, to cost $15,000.

QUINCY, ILL.—Plans are being prepared by W. B. Bushaell, engineer, for a pumping plant to cost $86,000.

ROCKFORD, ILL. — The Ingersoll Milling Machine Co. will build a reinforced concrete, 110 x 225 feet, addition to its plant.

ALLEGAN, MICH. — The Blood Brothers Machinery Co. plans to double the capacity of its plant within the next few months.

ALLEGAN, MICH.—The Allegan Steel Process Co. has been incorporated with $30,000 capital to build a plant for heat treatment and forging of steel.

BAY CITY, MICH.—The Commercial Body Co., a newly organized concern, will build a factory for the manufacture of automobile bodies.

BAY CITY, MICH.—The Bay City Foundry & Machine Co. is building an addition to the plant of the M. Garland Co. which it recently bought.

CHARLOTTE, MICH.—The L. M. H. Development Co. has been formed with $30,000 capital stock to manufacture a tractor with four-wheel drive, by Charles Martin, Jackson, Mich.; H. M. Leonard and John Hurlbut, Detroit.

DETROIT.—The Cadillac Motor Co. plans to spend $1,250,000 for factory extensions within the next few months. The Northway

Are You Prepared for the Future ?

There is a good supply of Iron Ore

RIGHT NOW—

but are you taking the Future into consideration?

The users of iron ore who take immediate advantage of the favorable conditions for obtaining it, will be well repaid.

And this is the reason:

The supply of iron ore for the coming year is small in comparison to what it has been. There is but a limited amount with which to meet the requirements of all users.

Therefore, someone is going to be disappointed—and naturally it will be those who don't order quickly.

It's a case of "first come first served" and not enough for everybody.

Order now!

We are in a most excellent position to interest you in *Service*, *Quality* and *Price*.

SHIPMENTS ARE MADE FROM OPEN PIT MINES

Don't take chances on your 1917 ore.

Let us fill your requirements

Crawford Ore; Lambert Ore; Pennington Ore

The Tod-Stambaugh Company

Perry-Payne Building

CLEVELAND - - OHIO

Motor Co., another subsidiary of the General Motors Co., will spend $250,000 shortly for factory improvements.

DETROIT.—The Ball & Ball Carburetor Co. has been incorporated with $20,000 by F. H. and F. O. Ball.

DETROIT.—Bids will be received until Dec. 12 by the board of water commissioners for two 37,000,000-gallon vertical, triple expansion, crank and fly-wheel pumping engines.

FREMONT, MICH. — The plant of the Michigan Head Lining Co. has been damaged by fire and will be rebuilt at once.

HOLLAND, MICH. — The Western Tool Works will build a plant 50 x 80 feet.

MUSKEGON, MICH.—Plans are being prepared by the Werner-Bradford-Mead Co. of Grand Rapids for the plant of the Keller Pneumatic Tool Co., which will be 1-story, 100 x 300 feet.

OWOSSO, MICH. — The Standard Machine Co. of Bay City, will build a plant at Owosso. J. C. Fetter and J. A. Bradford are owners.

MILWAUKEE. — The Anger Engineering Co., manufacturer of automobiles, will build a plant at Twenty-sixth and State streets. Klug & Smith, Mack building, are the architects.

MILWAUKEE. — The International Steel Products Co. has been incorported with $150,000 capital by G. F. Knoernschild, Henry W. Gottschalk and E. Krause.

NEW LONDON, WIS. — The Thomas Machine Shop Co. will build an addition.

POTTER, WIS.—Bids will be asked about Jan. 1 on a reinforced concrete bridge of seven 40-foot spans. W. M. Conway, Green Bay, Wis., is engineer.

KANSAS CITY, MO.—The West Automatic Injector Co. has been incorporated with $40,000 capital to manufacture steam injectors and other devices, by J. H. Arnold, Charles E. West and J. H. Dobbins.

KANSAS CITY, MO.—The Benson Automatic Speed Signal Co. has been incorporated with $100,000 capital stock to manufacture signals and safety devices, by E. M. Todd, O. M. West and C. R. Francisco.

ST. JOSEPH, MO.—The St. Joseph Structural Steel Co. plans to double its capacity. T. W. Dodd is president.

IOWA FALLS, IA.—The city of Iowa Falls plans to build a water works plant, requiring oil engines and electric motors.

MUSCATINE, IA. — The Armed Vise Co. has been formed by U. G. Bond and J. M. O'Brien to build a plant for the manufacture of acetylene welding apparatus.

DULUTH.—The Kelley-How-Thompson Co., hardware manufacturer, will build an addition costing $70,000. G. W. Wells is secretary.

MINNEAPOLIS.—The Knight Heating Co., Thirteenth and Lake streets, manufacturer of heaters, will build a factory costing about $25,000.

ST. PAUL.—The Wege Concrete Machinery Co. has been incorporated and will proceed at once to build a plant to cost $150,000. Incorporators are C. H. Edwards, A. J. Kroeger and E. F. Wege.

New Trade Publications

CHAIN DRIVES.—An illustrated folder describing the installation of chain drives to operate aniline vat kettles in the plant of the Schoellkolf Aniline & Chemical Works, Inc., Buffalo, N. Y., has been issued by the Link-Belt Co., Philadelphia. The kettles are driven by means of motors ranging in size from ¾ to five horsepower, and fully 1,000 drives are in use in the plant.

STEEL ALLOYS.—A 14-page folder has been issued by the Vanadium-Alloys Steel Co., Pittsburgh, describing the various types of alloy steel manufactured by the company. Several pages are devoted to a list of carbon steel extras for round, square and octagon shapes. A study of alloy steels, including brief mention of the various methods of producing alloy steel and some interesting information regarding the physical properties of steel which has undergone various methods of heat treatment, is also included in the pamphlet.

ELECTRIC HOISTS.—The Shephard Electric Crane & Hoist Co., Montour Falls, N. Y., has issued a folder devoted to electric, floor operated, single speed hoists. These hoists have capacities ranging from 500 to 2,000 pounds and are built for 110 or 220 volts. They are equipped with combined mechanical and electric brakes and are provided with automatic oil bath lubrication. The design is said to insure permanent alignment of working parts and effective exclusion of dirt and dust.

STOKERS.—A large folder showing how the installation of four stokers in the plant of the Scullin Steel Co., at St. Louis, enabled the plant to be operated with four boilers instead of six, has just been issued by the Laclede-Christy Clay Products Co., St. Louis. It is shown that on account of the fact that two of the boilers had outlived their usefulness, it was necessary to operate the plant on four boilers while new units were being installed. The problem was put up to the engineers of the Laclede-Christy company and they successfully overcame the difficulties involved by installing chain grate stokers.

FORGING FURNACES.—Tate, Jones & Co., Inc., Pittsburgh, have issued two bulletins devoted to small forging furnaces and large and medium sized forging furnaces. The construction of the three types is essentially the same; the sectional cast iron plates are ribbed and stayed so that the furnace will not warp out of shape. Fire brick linings are used and the furnaces are equipped to burn either oil or gas. The small forging furnaces are designed to handle a wide range of work, and the large furnaces are especially adapted to the heating of billets, large hammer and press work, and ingots.

BOILERS.—A 48-page catalog describing and illustrating downflow boilers and showing well known buildings in which these boilers have been installed, has been published by the Pardel Corporation, Philadelphia, successor to the Parker Boiler Co. The principle of the downflow system is explained with the aid of an evaporation diagram and the problems associated with safe operation, superheat and economy are discussed. The results of competitive and comparative tests are shown. The description of the boilers includes detailed information on the construction of the junction boxes, hand holes, valves, and other fixtures.

RHEOSTATS.—A recent bulletin issued by the power and mining department of the General Electric Co., Schenectady, N. Y., describes its various types of speed-regulating rheostats and panels for direct-current motors. The booklet is illustrated with views of the several control panels and presents some interesting details in regard to the operation of the apparatus. The classes of service to which the different types of controlers may be applied are also defined. The bulletin, which is identified as No. 48,320, in addition to the technical description, also contains several pages which are devoted to the mechanical features of the devices.

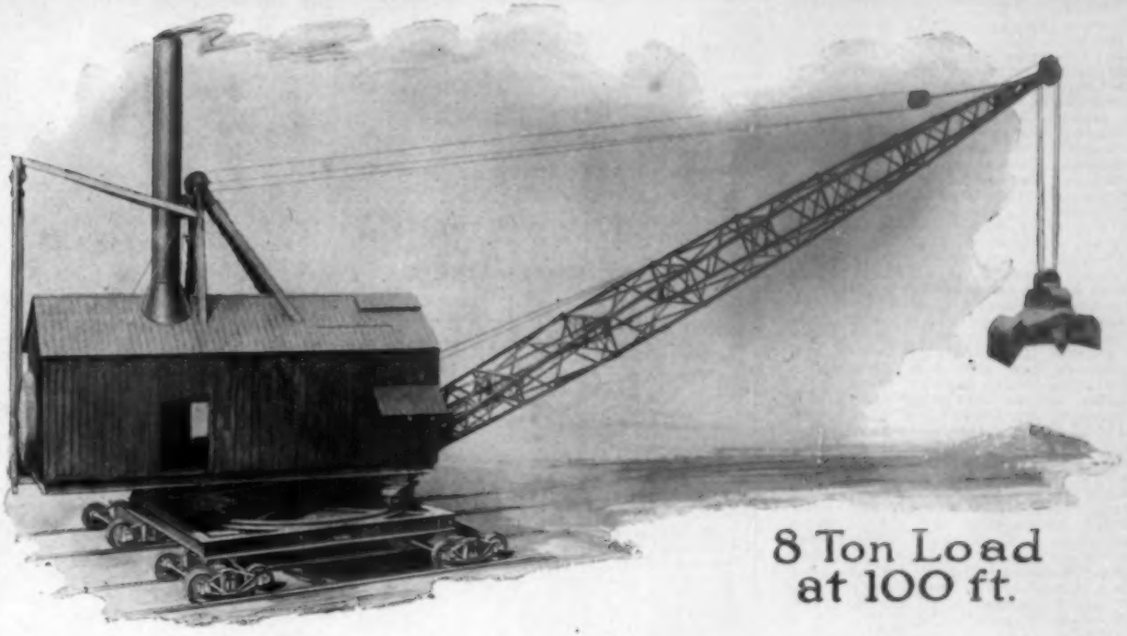
LATHES.—The Lodge & Shipley Machine Tool Co., Cincinnati, has issued a loose-leaf catalog containing descriptive matter relative to the operation of lathes manufactured by the company. Various parts of each machine are explained in detail and this is followed by a general description of the complete tool, together with an account of the uses to which the machine is adapted. The lathes listed include engine lathes with cone pulley and selective head arrangements for securing different spindle speeds, a portable lathe and one for heavy forgings. A bulletin giving examples of the work that has been done on the various machines is also included.

LUBRICATION.—A full line of lubricating oils and greases, automatic oilers, and other accessories is described in a bulletin recently issued by the Chicago Pneumatic Tool Co., Chicago. Complete directions for the proper care of pneumatic tools are given and particular emphasis is placed upon the relation between lubrication and cleanliness and efficient operation of the tool. It is pointed out that no pneumatic tool can possibly give good service if it is not kept clean so that the lubricating materials can perform their function. Considerable information regarding the use of oil and grease for lubrication, shipping weights of these materials in bulk, etc., is included in the bulletin.

HYDRAULIC VALVES AND FITTINGS.—The Watson-Stillman Co., Aldene, N. J., has published a 96-page catalog describing and illustrating a full line of hydraulic valves and fittings. Complete specifications are available for every article manufactured. In a brief foreword the company states that it has been engaged in the manufacture of hydraulic machinery since 1848. The valves and fittings are manufactured in bronze, forged steel and cast steel. Brief outlines of catalogs dealing with hydraulic forcing presses, pumps, railroad tools, benders, accumulators, punches and shears, chilling and die presses, jacks, leather belt presses, etc., are presented in the last few pages of the booklet.

GRINDING WHEELS. — The Star Corundum Co., Detroit, has issued a 100-page catalog on the subject of grinding wheels. The booklet discusses in detail not only sizes, qualities and styles of grinding apparatus, but also general safety rules that must be observed. According to a brief introductory chapter in the catalog, the grinding wheels manufactured by the Star company are made by the vitrified, silicate or elastic process. The vitrified covers the widest range, over 90 per cent of the Star company products being of this type. A page of the catalog is given over to a list of general suggestions and several pages are devoted to prices, weights and grades of wheels. Most of the catalog, however, deals with shapes. Every different shape of wheel is separately described and illustrated.

Do You Need a Large Crane



This BROWNHOIST Bucket Crane

will handle at 100 ft. radius

5	yds.	of COAL
3	"	" SAND
3	"	" GRAVEL
3	"	" STONE
3	"	" ORE

THERE are just two of these cranes left. And 90 days' shipment can be made on either or both.

These are wide gauge machines of very large capacity and great reach. Eight tons can be handled at 100 ft. radius, which means that the crane will work a grab bucket that weighs 8 tons or less when loaded and 60 to 70 trips can be made in an hour.

This is a good opportunity to get a large capacity crane with a delivery that is considered very good at these times.

IMPORTANT: We have just sold one of these machines, but there are two left. These can be completed and shipped in 90 days.

Write or wire us for price and any other details.

The Brown Hoisting Machinery Co.
Cleveland, Ohio, U. S. A.

Engineers and Manufacturers of Cranes and Hoists

Branch Offices in New York, Pittsburgh, Chicago, San Francisco, Montreal and Portland, Ore. (Colby Eng'r Co.)

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

Bessemer valley	$35.00
Bessemer, Pittsburgh	35.95
Basic, Pittsburgh	30.95
Basic, eastern Pa.	30.00 to 30.50
Basic, Buffalo	29.00 to 30.00
Malleable, Pittsburgh	30.95
Malleable foundry, Chicago	27.00 to 28.00
Malleable foundry, Philadelphia	32.00 to 33.00
Malleable foundry, Buffalo	29.00 to 30.00
No. 1X foundry, Philadelphia	29.00 to 29.50
No. 2 foundry, Pittsburgh	30.95
No. 2 foundry, Cleveland	30.30 to 31.30
No. 2 foundry, Ironton	29.00 to 30.00
No. 2 foundry, Chicago	27.00 to 28.00
No. 2X foundry, Philadelphia	28.00 to 29.00
No. 2X foundry, N. J. tidewater	28.00 to 29.00
No. 2X foundry, Buffalo	29.00 to 30.00
No. 2 plain, Philadelphia	27.50 to 28.00
No. 2 plain, N. J. tidewater	27.50 to 28.00
No. 2 plain, Buffalo	29.00 to 30.00
No. 2 southern, Birmingham	22.00 to 25.00
No. 2 southern, Cincinnati	24.90 to 27.90
No. 2 southern, Chicago	25.00 to 26.00
No. 2 southern, Phila. delivery	26.00 to 28.00
No. 2 southern, Cleveland	25.00 to 26.00
No. 2 southern, New York docks	26.25 to 28.25
No. 2 southern, Boston docks	26.00 to 28.00
No. 2 south. interior, New Eng.	27.00 to 29.00
No. 2 southern, St. Louis	18.40 to 18.90
Virginia No. 2X furnace	26.00 to 28.00
Virginia, No. 2X, Philadelphia	28.75 to 30.75
Virginia, No. 2X, Jersey City	29.00 to 31.00
Virginia 2X, Boston points	29.25 to 31.25
Gray forge, eastern Pa.	26.50 to 27.00
Gray forge, Pittsburgh	29.95
Gray forge, Birmingham	21.00
Silveries, 8 per cent, furnace	36.00 to 37.00
Silveries, 8 per cent, Chicago	38.50
Low phos. Standard, Phila.	50.00 to 51.00
Low phos. Lebanon, Pa., furnace	48.00 to 49.00
Low phos., Pittsburgh	43.00 to 45.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	30.75 to 31.75
Charcoal, Buffalo	24.00 to 27.00
Charcoal, Birmingham	22.50 to 23.00

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	5.95
Mesabi Bessemer, 55 per cent, ton	5.70
Old range non-Bes., 51½ per cent, ton	5.20
Mesabi non-Bess., 51½ per cent, ton	5.05

Foreign Ores.
(Per unit Philadelphia.)

Foreign Bess., 50 to 65 per cent	nominal
For'n non-Bess., 50 to 65 per cent	nominal

COKE

(At the ovens.)

Connellsville furnace	$7.50 to 8.00
Connellsville fur., contract	3.75 to 4.00
Connellsville foundry, contract	6.00 to 6.75
Connellsville foundry	9.00 to 9.50
Wise county furnace, contract	4.50 to 5.00
Wise county foundry, contract	5.00 to 7.00
Pocahontas foundry, contract	5.00 to 7.00
Pocahontas furnace, contract	4.50 to 5.00
New River foundry, contract	5.25 to 5.75
New River furnace, contract	5.00 to 5.50

FERRO ALLOYS AND STEEL MAKING METALS

Ferro manganese, 80 per cent, seaboard, or delivered prompt	$160 to 165
Ferro manganese, 80 per cent, seaboard, or delivered, contract	160 to 165
Spiegel, 20 per cent, fur. early and last half	50.00 to 55.00

Ferro-silicon, 50 per cent, Pbg. 95.00 to 100.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $41.00; 10 to 11 per cent, $42.00; 11 to 12 per cent, $43.00; 12 to 13 per cent, $44.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

SEMI-FINISHED MATERIAL

Open hearth billets, Phila	$55.00 to 60.00
Forging billets, Phila	70.00 to 75.00
Forging billets, Pbgh., nominal	75.00 to 85.00
Forging billets, Chicago	70.00
Wire rods, Pittsburgh (nom.)	65.00 to 70.00
Bessemer billets, Youngstown	55.00 to 60.00
Bessemer billets, Pittsburgh	55.00 to 60.00
Open hearth billets, Pittsburgh	55.00 to 60.00
Open hearth billets, Youngstown	55.00 to 60.00
Bess. sheet bars, Youngstown	55.00 to 60.00
Op. h'th sheet bars, Youngstown	55.00 to 60.00
Bess. sheet bars, Pittsburgh	55.00 to 60.00
Open hearth sheet bars, Pbgh.	55.00 to 60.00
Muck bars, Pittsburgh (nominal)	50.00

SKELP

Grooved steel skelp	3.00c
Sheared steel skelp	3.50c

RAILS AND TRACK MATERIAL

(Gross tons.)

Stand. Bess. rails, Pbgh & Chgo.	$38.00
Stan. op-h'th rails, Pbg. & Chgo.	40.00
Light rails 8 to 10 lbs., Pbgh.	49.00
Light rails, 8 lb., Chicago	48.00
Light rails, 12 to 14 lbs., Pbgh.	48.00
Light rails, 12 lbs., Chicago	46.00
Light rails, 16 to 20 lbs., Pbgh.	47.00

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brooklyn (by canal)	1.25 to 1.60
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (r. and w.)	4.25
Philadelphia (all rail)	5.20
Philadelphia (r. and w.)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.40
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails, 16 to 20 lbs., Chgo.	$45.00
Light rails, 25 to 45 lbs., Pbgh.	46.00
Light rails, 25 to 45 lbs., Chgo.	44.00
Relaying rails, standard, Pbgh. and Chicago	$23.00 to 24.00
Relaying rails light, Chicago	24.00 to 25.00
Angle bars, st. sect., Pbgh. base	2.00c to 2.50c
Angle bars, st. sections, Chgo.	2.25c to 2.75c
Spikes, railroad, Pittsburgh	2.65c to 2.75c
Spikes, railroad, Chicago	3.00c to 3.10c
Track bolts, Pittsburgh	4.50c to 4.75c
Track bolts, Chicago	4.25c to 4.50c
Tie plates, Chicago	$55.00 to 60.00

SHAPES, PLATES AND BARS

Structural shapes, con. Pbgh.	3.00c
Structural shapes, Pbgh	3.00c to 3.25c
Structural shapes, Philadelphia	3.159c to 3.409c
Structural shapes, Chicago	3.19c to 3.75c
Structural shapes, New York	3.169c to 3.419c
Tank plates, Chicago	3.69c to 4.25c
Tank plates, Pittsburgh (con.)	3.50c to 4.50c
Tank plates, Pittsburgh	4.00c to 4.50c
Tank plates, Philadelphia	3.659c to 4.159c
Tank plates, New York	3.669c to 4.169c
Bars, soft steel, Chicago	3.09c to 3.50c
Bars, soft steel, Pbgh (con.)	2.90c
Bars, soft steel, Pittsburgh	3.00c to 3.25c
Bars, soft steel, New York	3.169c
Bars, soft steel, Philadelphia	3.159c
Hoops, carloads, Pbgh. contr.	3.25c
Hoops, Pbgh.	4.00c to 4.25c
Bands, Pittsburgh	3.90c to 4.10c
Bands, Pittsburgh (contr.)	2.90c
Shafting, Pbgh., contr. carloads	10 to 20 off
Bar iron, Chicago	2.65c to 2.75c
Bar iron, Philadelphia	2.909c
Bar iron, Cleveland	3.00c
Bar iron, New York	2.919c
Bar iron, Pittsburgh	3.25c
Hard steel bars, Chicago	2.70c to 2.75c

SHEETS

(In cents per pound.)
(Open hearth material takes 10c above prices of bessemer.)

SHEET MILL BLACK.

Gage.	Bessemer.
17 to 21	4.30 to 4.55
22 to 24	4.35 to 4.60
25 and 26	4.40 to 4.65
27	4.45 to 4.70
28	4.50 to 4.75
29	4.55 to 4.80
30	4.65 to 4.90

TIN MILL BLACK.

Gage.	Bessemer.
15 and 16	4.05 to 4.30
17 to 21	4.10 to 4.35
22 to 24	4.15 to 4.40
25 to 27	4.20 to 4.45
28	4.25 to 4.50
29 and 30	4.30 to 4.55
30½ and 31	4.35 to 4.60

GALVANIZED.

Gage.	Bessemer.
10 and 11	4.50 to 5.00
12 to 14	4.60 to 5.10
15 and 16	4.75 to 5.25
17 to 21	4.90 to 5.40
22 to 24	5.05 to 5.55
25 and 26	5.20 to 5.70
27	5.35 to 5.85
28	5.50 to 6.00
29	5.70 to 6.20
30	5.90 to 6.40

BLUE ANNEALED.

Gage.	Bessemer.
3 to 8	3.90 to 4.15
9 to 10	3.75 to 4.00
11 to 12	3.75 to 4.00
13 and 14	3.85 to 4.10
15 and 16	3.85 to 4.15

No. 28 black, Chicago	4.19c to 4.44c
No. 28 galvanized, Chicago	5.19c
No. 10 blue annealed, Phila.	3.659c to 4.159c
No. 10 blue annealed, Chgo.	3.69c to 3.94c

TIN PLATE

Tin plate, 100 lb., coke base	6.50c to 7.00c
Terne plate	5.75c

IRON AND STEEL PIPE

(Prices adopted Dec. 4, 1916.)

Steel. Butt weld:—	Black.	Galv.
⅛, ¼ and ⅜ in.	59	32½
½ in.	63	48½
¾ to 3 in.	66	52½
Lap weld:—		
2 in.	59	46½
2½ to 6 in.	62	49½
7 to 12 in.	59	45½
13 and 14 in.	49½	....
15 in.	47	....

Iron. Butt weld:—	Black.	Galv.
⅛ and ¼ in.	44	16
⅜ in.	45	17
½ in.	49	30
¾ to 1½ in.	52	35
Lap weld:—		
1¼ in.	38	22
1½ in.	44	29
2 in.	45	30
2½ to 6 in.	47	33
7 to 12 in.	46	32

BOILER TUBES

Steel, 3½ to 4½ inches l. c. l.	46
Iron 3½ to 4½ inches l. c. l.	36

IRON AND STEEL PRICES

Corrected up to Tuesday noon

WIRE PRODUCTS

(Adopted Nov. 24, 1916.)
(Retailers' price 5 cents above jobbers' quotations.)

Wire nails, jobbers', Pittsburgh	$3.00
Plain wire, jobbers', Pittsburgh	2.95
Galvanized wire, jobbers', Pbgh	3.65
Polished staples, Pbgh	3.15
Galvanized staples, Pbgh	3.85
Barb wire, painted, jobbers', Pbgh.	3.15
Barb wire, galv., jobbers', Pbgh.	3.85

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled thread, 50; cut threads, 40, 7 and ½, larger or longer, 35.

Machine bolts with hot pressed nuts ⅜ x 4 inches, smaller or shorter rolled 50, and 5; cut, 40, 10 and 5; larger or longer, 40.

Cold pressed, semi-finished hexagon nuts, 60.

Gimlet and cone point lag bolts, 50. Hot pressed square nuts, blanks, $2.60 off; tapped $2.40 off. Hot pressed hexagon nuts, blank, $2.60 off; tapped, $2.40 off.

Cold pressed square nuts, blank, $2.20 off; tapped, $2.00 off. Cold pressed hexagon nut, blank, $2.50 off; tapped, $2.25 off.

RIVETS

Structural rivets, Pbgh	4.25c
Boiler rivets, Pbgh	4.35c
Tinner's rivets, 45, and 10 off, Pittsburgh.	

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	3.00c

STANDARD STEEL CHAIN

Chain, ¾ inch proof coil	5.50c

COLD ROLLED STRIP STEEL

Base price 6.50c to 7.00c per 100 pounds, hard, coils 1½ inches and wider and by .100 inch and heavier.

CAST IRON WATER PIPE

Four-inch, Chicago	$42.00 to 43.00
Six-inch and larger, Chicago	39.00 to 40.00
Six-inch Class B, New York	39.50
Four-inch Class B, New York	42.50
Four to six-inch Birmingham	37.00
Six-inch and larger, Birmingham	34.00

Light weight water and gas pipe $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	3.60c
Steel squares, 2-in. & ov., Cleve.	4.25c
Steel rounds, 2-in. & ov., Cleve.	4.25c
Steel bars, und. 2 in., Cleveland	3.75c
Steel bars, Detroit	3.35c
Steel bars, Philadelphia	3.50c
Steel bars, New York	3.75c
Steel bars, St. Louis	3.65c
Steel bars, Cincinnati	3.70c to 4.25c
Steel bars, St. Paul	3.70c
Steel bars, over 2-in., Buffalo	4.40c
Steel bars, Buffalo	3.75c
Iron bars, Chicago	3.60c
Iron bars, Cleveland	3.70c
Iron bars, Detroit	3.35c
Iron bars, St. Louis	3.60c
Iron bars, Cincinnati	3.70c to 4.25c
Iron bars, Philadelphia	3.50c
Iron bars, New York	3.75c
Shapes, Chicago	3.70c
Shapes, Detroit	3.45c
Shapes, St. Louis	3.75c
Shapes, St. Paul	3.80c
Shapes, New York	3.75c
Shapes, Cleveland	3.85c
Shapes, Philadelphia	3.50c
Shapes, Buffalo	3.85c
Shapes and plates, Cincinnati	3.80c to 4.35c
Plates, Chicago	4.35c
Plates, Detroit	4.10c
Plates, St. Louis	4.40c
Plates, St. Paul	4.45c
Plates, New York, wide	5.00c
Plates, New York, narrow	4.75c
Plates, Cleveland	4.35c
Plates, Philadelphia	4.25c to 4.75c
No. 10 blue anl. sheets, Chicago	4.00c
No. 10 blue anl. sheets, Cleve.	4.15c
No. 10 blue anl. sheets, Buffalo	3.25c
No. 10 blue anl. sheets, St. L.	4.05c
No. 10 blue anl. sheets, Cinci.	4.15c
No. 10 blue anl. sheets, St. Paul	4.15c
No. 10 blue anl. sheets, Detroit	3.80c
No. 28 black sheets, Chicago	4.60c
No. 28 black sheets, Cleveland	4.50c
No. 28 black sheets, Cincinnati	4.15c
No. 28 black sheets, Detroit	4.10c
No. 28 black sheets, St. Louis	4.75c
No. 28 black sheets, St. Paul	4.75c
No. 28 galv. sheets, Chicago	6.50c
No. 28 galv. sheets, Cleveland	6.00c
No. 28 galv. sheets, Cincinnati	5.75c
No. 28 galv. sheets, Detroit	5.50c
No. 28 galv. sheets, St. Louis	6.60c
Hoops, Cleveland	4.50c

Freight Rates, Coke

Connellsville district, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.85
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

Angle bars, iron, Chicago	$29.00 to 30.00
Angle bars, steel, St. Louis	21.00 to 21.50
Arch bars and transoms, Chgo.	30.00 to 31.00
Arch bars and transoms, St. L.	28.50 to 29.00
Boiler plate, cut, No. 1, Chgo.	15.00 to 15.50
Boiler plate, cut, No. 1, St. L.	14.00 to 14.50
Boiler punchings, Chicago	18.00 to 19.00
Bundled sheet, Cincinnati	11.00 to 11.50
Busheling, No. 1, Chicago	19.00 to 19.50
Busheling, No. 1, Cincinnati	16.50 to 17.00
Busheling, No. 1, Cleveland	19.00
Busheling, No. 1, St. Louis	19.50 to 20.00
Busheling, No. 2, Chicago	14.00 to 14.50
Cast borings, Chicago	10.25 to 10.75
Cast borings, Cincinnati	8.00 to 8.50
Cast borings, Cleveland	11.00 to 11.50
Cast borings, St. Louis	10.00 to 10.50
Cast, No. 1, Chicago	16.50 to 17.00
Cast, No. 1, Cincinnati	15.50 to 16.00
Cast, No. 1, Cleveland	19.00 to 19.50
Cast, No. 1, St. Louis	16.50 to 17.00

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—

New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Detroit	15.7 cents
Minneapolis and St. Paul	32.9 cents
Denver	83.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast (all rail)	73.9 cents
Pacific coast (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Cut forge, Chicago	24.75 to 25.25
Grate bars	15.00 to 15.25
Iron axles, St. Louis	33.50 to 34.00
Iron axles, Cleve	40.00
Knuckles, coup., Chicago	24.00 to 24.50
Knuckles, coup., St. Louis	24.50 to 25.00
Locomotive tires, Chicago	29.00 to 30.00
Locomotive tires, St. Louis	28.00 to 29.00
Machine shop turnings, Chicago	10.25 to 10.75
Machine shop turnings, Cleve.	10.50 to 11.00
Machine shop turn'gs, Cincinnati	8.50 to 9.00
Machine shop turnings, St. L.	11.50 to 12.00
Malleable agricultural, Chgo.	15.00 to 15.50
Malleable agricultural, St. Louis	15.50 to 16.00
Malleable, Cincinnati	12.00 to 12.50
Malleable railroad, Chicago	18.00 to 18.50
Malleable railroad, St. Louis	16.50 to 17.00
Pipes and flues, Cleveland	16.00 to 16.50
Pipes and flues, Chgo	16.50 to 17.00
Pipes and flues, St. Louis	16.50 to 17.00
Railroad wrought, No. 1, Cleve.	29.00 to 30.00
Railroad wrought, No. 1, Chgo.	25.00 to 25.50
Railroad wrought, No. 1, Cinci.	18.00 to 18.50
Railroad wrought, No. 1, St. L.	22.50 to 23.00
Railroad wrought, No. 2, Chgo.	24.75 to 25.25
Railroad wrought, No. 2, St. L.	21.50 to 22.00
Shafting, St. Louis	28.00 to 29.00
Springs, Chicago	24.00 to 24.50
Steel car axles, St. Louis	38.00 to 39.00
Steel car axles, Chicago	39.00 to 40.00
Stove plate, Chicago	11.25 to 11.75
Stove plate, Cleveland	15.00 to 15.50
Stove plate, Cincinnati	11.00 to 11.50
Stove plates, St. Louis	15.00 to 15.50

(Gross tons.)

Axle turnings, Cleveland	$16.25
Busheling, No. 1, Buffalo	18.50 to 19.00
Busheling No. 1, Pittsburgh	18.50 to 19.00
Busheling, No. 2, Buffalo	14.00 to 14.50
Bundled sheets, Pittsburgh	14.75 to 15.25
Bundled sheets, Cleveland	14.50 to 15.00
Bundled sheets, Buffalo	14.50 to 15.00
Bundled tin, Buffalo	13.50 to 14.00
Car wheels, (iron), Pittsburgh	25.00 to 26.00
Car wheels, (steel), Pittsburgh	27.50 to 28.00
Car wheels, Chicago	21.50 to 22.00
Car wheels, eastern Pa	22.00 to 23.00
Car wheels, Buffalo	19.50 to 20.00
Car wheels, New York	20.00 to 20.50
Car wheels, St. Louis	19.50 to 20.00
Car wheels, Birmingham	15.50 to 16.00
Tram car wheels, Birmingham	14.50 to 15.00
Cast borings, New York	10.00 to 11.00
Cast borings, eastern Pa	14.00 to 15.00
Cast borings, Buffalo	10.50 to 11.00
Cast borings, Pittsburgh	12.50 to 13.00
Cast, No. 1, eastern Pa	21.00 to 21.50
Cast, No. 1, Pittsburgh	20.00 to 22.00
Cast, No. 1, Birmingham	17.50 to 18.00
Cast, heavy No. 1, N. J. points	18.50 to 19.00
Forge, No. 1, eastern Pa	15.50 to 16.50
Frogs, switches, guards, St. L.	22.50 to 23.00
Grate bars, Buffalo	15.50 to 16.00
Grate bars, N. J. points	14.75 to 15.00
Heavy axle turnings, Buffalo	15.00 to 15.50
Heavy melting steel, Pittsburgh	24.00 to 25.00
Heavy melting steel, Buffalo	21.50 to 22.00
Heavy melting steel, Chicago	23.00 to 24.00
Heavy melting steel, Cleveland	24.50 to 25.00
Heavy melting steel, Cincinnati	20.50 to 21.50
Heavy melting steel, eastern Pa.	24.00 to 25.00
Heavy melting steel, New York	21.00 to 22.00
Heavy melting steel, St. L.	23.50 to 24.00
Heavy melting steel, Birmingh'm	17.50 to 18.00
Hydraulic pressed sheet, Cleve.	18.00 to 18.50
Hydraulic pressed sheets, Pbgh.	19.50 to 20.00
Hydraulic pressed sheets, Chgo.	18.00 to 19.00
Iron rails, Chicago	29.00 to 30.00
Iron rails, Buffalo	22.00 to 22.50
Iron rails, Cincinnati	23.50 to 24.00
Iron rails, St. Louis	25.00 to 26.00
Iron rails, Cleveland	29.00 to 30.00
Iron axles, Pittsburgh	39.00 to 40.00
Iron axles, Cincinnati	38.00 to 40.00
Iron axles, eastern Pa	38.00 to 40.00
Iron axles, Chicago	42.00 to 42.50
Iron axles, Buffalo	35.00
Low phos. steel, Buffalo	27.50 to 28.00
Low phos. steel, Pittsburgh	30.00 to 32.00
Low phos. steel, eastern Pa	31.00 to 33.00
Machine shop turnings, Buffalo	10.50 to 11.00
Mch. shop turnings, New York	10.00 to 10.50
Mch. shop turnings, Pittsburgh	12.00 to 12.50
Mch. shop turnings, eastern Pa	13.00 to 14.00
Mch. shop turnings, Birmingham	8.00 to 9.00
Malleable railroad, Cleveland	22.50 to 23.00
Malleable railroad, Buffalo	19.00 to 19.50
Malleable railroad, Pittsburgh	20.50 to 21.00
Malleable railroad, eastern Pa	18.00 to 19.00
R. R. car wheels, Cleve	24.00 to 24.50
R. R. and mch. cast, No. 1 Bfl.	19.50 to 20.00
R. R. wrought, No. 1, Buffalo	26.50 to 27.00
R. R. wrgt., No. 1, eastern Pa.	26.00 to 27.00
City wrought, New York	17.50 to 18.00
R. R. wrought, No. 1, Pbgh	24.50 to 25.50
R. R. wrought, No. 1, B'ham	17.50 to 18.00
Reroll. rails, 5 ft. and ov., Pbg.	28.00 to 30.00
Reroll. rails, 5 ft. & ov., Chgo.	29.50 to 30.00
Reroll. rails, 5 ft. & ov., E. Pa.	27.00 to 28.00
Reroll. rails, 5 ft. & ov., St. L.	27.50 to 28.00
Shafting, New York	26.00 to 28.00
Shafting, eastern Pa	28.00 to 30.00
Shoveling steel, Chgo	21.50 to 22.00
Shoveling steel, St. Louis	20.00 to 20.50
Steel rails, short, Chgo	25.50 to 26.00
Steel rails, short, Cleveland	27.50 to 28.00
Steel rails, over 6 ft. Cleveland	26.00 to 27.00
Steel rails, old, Birmingham	17.50 to 18.00
Steel rails, short, St. Louis	26.50 to 27.00
Steel car axles, Birmingham	26.00 to 27.00
Steel car axles, New York	28.00 to 40.00
Steel car axles, Buffalo	35.00
Steel car axles, Cleveland	44.00
Steel car axles, Pittsburgh	39.00 to 40.00
Steel car axles, eastern Pa	38.00 to 40.00
Stove plate, N. J. points	15.00 to 15.50
Stove plate, Birmingham	12.50 to 13.50
Stove plate, Buffalo	14.75 to 15.00
Stove plate, eastern Pa	17.00 to 18.00
Stove plate, Pittsburgh	14.00 to 14.50
Wrought pipe, Buffalo	16.00 to 16.50
Wrought pipe, eastern Pa	19.00 to 20.00
Wrought pipe, New York	17.00 to 19.00

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A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶ Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

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ALUMINUM.
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United Smelt'g & Alum. Co., New Haven, Ct.

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Blackwood Steel Fdy. Co., The, Springfield, O.
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Mesta Machine Co., Pittsburgh, Pa.
Pittsburgh Annealing Box Co., Pittsburgh, Pa.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Swedish Crucible Steel Co., Detroit, Mich.
United Engrg. & Foundry Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

ANTIMONY.
Wah-Chang Mining & Smelting Co., New York City.

ANTIMONY OXIDES.
Wah-Chang Mining & Smelting Co., New York City.

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Lakewood Engrg. Co., Cleveland, O.

AUTO TOWING CABLES.
American Steel & Wire Co., Chicago, Ill.

AXLES.
American Bridge Co., New York City.
American Steel Export Co., New York City
Bethlehem Steel Co., So. Bethlehem, Pa.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Co., Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.

BABBITT METAL.
Keystone Bronze Co., Pittsburgh, Pa.
Lubricating Metal Co., The, New York City.
Ryerson, Jos. T., & Son, Chicago, Ill.

BAKERS, WIRE COATING.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BALE TIES.
American Steel & Wire Co., Chicago, Ill.

BALLS.
(Steel.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.
New Departure Mfg. Co., Bristol, Conn.

BANDS.
(Steel.)
Akron-Selle Co., The, Akron, O.
Carnegie Steel Co., Pittsburgh, Pa.

BARGES.
(Steel.)
American Bridge Co., New York City.

BARRELS, TUMBLING.
(Wire Nails.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BARS—ALLOY.
Central Steel Co., The, Massillon, O.

BARS.
(Concrete Reinforcing.)
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Inland Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Ryerson, Jos. T., & Son, Chicago, Ill.
Trussed Concrete Steel Co., Detroit, Mich.
Upson Nut Co., Cleveland, O.

BARS.
(Iron and Steel.)
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Company, Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Harvey, Arthur C., Co., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
United Alloys Steel Corp., The, Canton, O.
Upson Nut Co., Cleveland, O.
Westerman & Co., Lockport, N. Y.

BEAMS, CHANNELS AND ANGLES.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Empire Art Metal Co., College Pt., N. Y.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

BEARINGS.
(Ball.)
New Departure Mfg. Co., Bristol, Conn.

BEARINGS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

BELT CEMENT AND DRESSING.
Graton & Knight Mfg. Co., Worcester, Mass.
Texas Company, The, New York City.
Williams, I. B., & Sons, Dover, N. H.

BELT LACING.
(Leather.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BELTING.
(Chain.)
Link-Belt Company, Chicago, Ill.

BELTING—LEATHER.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BENCHES.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

BENCHES AND FRAMES.
(Drawing.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., The, Cuyahoga Falls, O.

BENDING AND STRAIGHTENING MACHINES.
Abramsen Engrg. Co., Pittsburgh, Pa.
Bertsch & Co., Cambridge City, Ind.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hinman, D. A., & Co., Sandwich, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

BENZOL, RECOVERY PLANTS.
Koppers, H., Co., Pittsburgh, Pa.

BESSEMER SQUARES.
(Soft.)
Witherow Steel Co., Pittsburgh, Pa.

BILLETS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown.

BINS.
(Steel.)
Empire Art Metal Co., College Pt., N. Y.

BLAST FURNACE SKIP CARS.
Lakewood Engrg. Co., Cleveland, O.

BLAST FURNACE TUYERES.
Keystone Bronze Co., Pittsburgh, Pa.

BLAST FURNACE VOLUME METERS.
Clark, Chas. J., Chicago, Ill.

BLOCKS.
(Chain.)
Yale & Towne Mfg. Co., New York City.

BLOOMS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Hillman, J. H., & Sons, Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

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